U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

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A Study of Monitoring Required in Regulation of Airport Noise. Volume II

Hydrospace-Challenger, Inc, San Diego

Prepared for

Environmental Protection Agency, Washington, D C

Sep 74

272046

PB 258 153

EG&G
HYDROSPACE-CHALLENGER, INC.

Volume II

A STUDY OF MONITORING REQUIRED IN REGULATION OF AIRPORT NOISE

Prepared for

ENVIRONMENTAL PROTECTION AGENCY

under

Contract No. 68-01-2686

Revised September 1974

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The volume relates to the reporting of current basic characteristics, mode of application, and effectiveness of airport noise monitoring systems in operation at airports in the United States and abroad. Background information is presented concerning proposed airport noise regulations in the United States. Noise monitoring equipment and procedures are discussed.

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Methodology,	Recording.
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Noise reduction,	
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Sites,	
Weather,	

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*Airport noise.

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Section 1
SURVEY REQUEST

As part of the survey of existing airport noise monitoring systems, letters requesting information were sent to both airports and equipment manufacturers. The following documents consist of:

a. Letter requesting information.
b. Background information attached to letter.
c. An example of the detailed form which has been filled in.

EG&G

HYDROSPACE-CHALLENGER, INC., 1300 ROSECRANS STREET, SAN DIEGO, California 92106
TEL. (714) 224-3235

8 July 1974

Airport Manager
Munich Airport
Munich, Germany

Subject: Noise Monitoring Systems

Gentlemen:

Hydrospace-Challenger, Inc., under Environmental Protection Agency (EPA) Contract WA74-R326, is tasked to "Study Monitoring Required in Regulation of Airport Noise." A sub-task requires reporting of the current basic characteristics, mode of application, and effectiveness of airport noise monitoring systems in operation at airports in the United States and abroad. We are currently assembling data for this report and would like your assistance in obtaining information regarding the noise monitoring at Munich Airport.

We are enclosing some background information (Appendix A) concerning proposed airport noise regulations in the United States. As can be noted, noise monitoring is an important consideration. The noise monitoring equipment and procedures of your system provide current experience which would facilitate development of the airport noise regulations.

Enclosed is a detailed form (Appendix B) on which to describe your noise monitoring system. Some of the entries may not be applicable to your system and others may address details unknown to you. We would appreciate having those pertinent data filled in. As an example we have included a response (Appendix C) concerning San Diego International Airport.

Your cooperation in providing this data for inclusion in the EPA report is appreciated. We realize that a significant effort is involved to collect the data for the form and as the draft report is due within 30 days we thank you for spending your time in replying promptly.

Sincerely,

Mrs. Carole S. Tanner

(Mrs.) Carole S. Tanner
Project Engineer

CST:cb
Enclosures (3)

Appendix A

BACKGROUND FOR AN AIRPORT NOISE REGULATION

EPA committed in the Administrator's "Report to Congress on Aircraft/Airport Noise," dated July 1973, to develop and propose to the FAA a series of regulations including:

a. Noise abatement flight operation regulations;

b. Regulations affecting the design and retrofit of aircraft to limit their noise emission capability;

c. An airport noise regulation.

The purpose of the airport noise regulation program is to establish a Federal mechanism for limiting the noise exposure in communities around airports.

The prevention or decrease of noise exposure or noise impact from aircraft noise associated with airport activity requires:

a. Making aircraft inherently quieter and having them flown as quietly as possible.

b. Designing or modifying the total operating plan of the airport so as to minimize the extent of the airport noise impact zone and tailor its shape to avoid existing noise-sensitive land uses where possible.

c. Preventing buildup of new housing or other noise-sensitive land uses in present and anticipated future noise zones, and where necessary, resolving by land use measures (soundproofing or conversion) those few impacted areas where the noise exposure cannot be adequately decreased by other means.

Item (a) is the subject of the aircraft noise emission and flight operation regulations under development by FAA and EPA; they will be necessary to achieve large reductions in the magnitude of the noise impact at most currently impacted airports. Items (b) and (c) will be added to results of Item (a) through implementation of the airport noise regulatory program.

The process being considered by EPA is as follows. After the promulgation of the general Federal airport noise regulation by the FAA, the existing airports with jet operations would be reviewed by the FAA according to some priority system to be proposed by EPA. Proprietors of airports identified by the FAA as a result of this review would be required to submit to the FAA their time-phased long range implementation plans. Development of implementation plans for each airport would be done by a process of local consultation involving local governments and the public. Quantitative estimation of the effectiveness of various alternative present and future operational modes for the airport would be carried out by the airport proprietor as part of the local development of the implementation plan. The social, economic, and other consequences of each "alternative future" or alterative implementation plan for the airport would be subjected to public scrutiny and discussion, so that the implementation plan most desired at the local/regional level could be arrived at and its major implications for the region (including both (1) the associated limitations on future type and level of air service and (2) the required commitments to land development control and/or recycling) understood by all. The airport proprietor would carry a major leadership responsibility during this process of developing alternative implementation plans and arriving at a "preferred plan," but active participation by local and regional planning agencies would also be required.

A necessary part of the implementation of an airport noise regulation will be the monitoring of progress in controlling or reducing the impact of the noise generated by aviation activity associated with the airport. Although a computerized noise model will be made available for the estimation of airport noise environments during the development of airport implementation plans, actual measurement of the noise environment is expected to be necessary, for two purposes: (1) to confirm actual progress in controlling or decreasing the cumulative noise exposure levels at various points on the ground, and (2) to provide a tool for controlling individual facets of the airport's implementation plan which require cooperation by others, such as aircraft operators.

At a minimum, the regulation is expected to contain a definition of the minimum legal requirement for monitoring (including a performance specification) and to require affected airport proprietors to submit their proposed monitoring programs as a part of the implementation plan they submit for FAA approval.

Since the airport noise regulation will require implementation by a wide variety of airports, a range of monitoring systems/procedures is implied. That is, a considerable expense for monitoring may be warranted at large airports generating major impact problems, but the same scale and approach to monitoring would not be appropriate to intermediate hub airports or general aviation airports (with business jet activity) generating little impact. Over the range of airport and impact size, the same monitoring system performance specification may be expected to result in a spectrum of actual systems, each system having differing hardware and software characteristics, personnel requirements, capital and operating costs, requirements for continuous measurement versus periodic sampling, etc.

Table III. Airport Location and Physical Features

LOCATION: San Diego, California, USA

LATITUDE: 32° 44' N

LONGITUDE: 117° 11' W

ELEVATION: 15 feet

TERRAIN: Coastal airport surrounded by 300- to 400-foot hills

APPROACHES: Populated residential and downtown business area

GENERAL LOCATION MAP

SAN FRANCISCO
LOS ANGELES
SAN DIEGO

TOTAL JET OPS: 274/day

DAY: 200

EVE: 58

NIGHT: 16

NIGHT RESTRICTIONS: See Note ①

DATE INSTALLED: February '74

TERMINAL TRACKING: ILS Runway 9

VIOLATION LEVEL: SITE 1: [illegible] dBA, SITE 2: [illegible] dBA, SITE 3: [illegible] dBA

VIOLATION HISTORY:

1. None to date.
2. History of complaints from residences northwest of runway.

INSTALLATION MAP

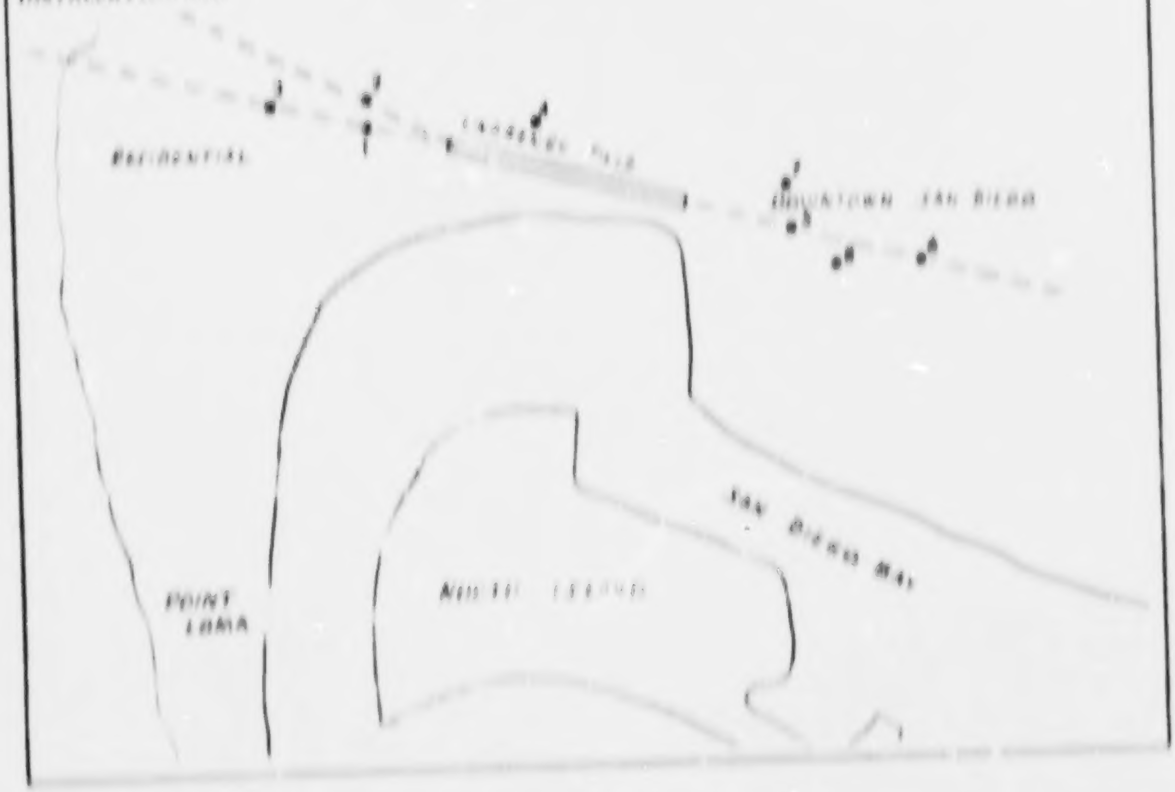

RESIDENTIAL
LINDBERGH FIELD
DOWNTOWN SAN DIEGO
SAN DIEGO BAY
NORTH ISLAND
POINT LOMA

Table III. Airport Location and Physical Features, Contd

SYNOPSIS OF SYSTEM

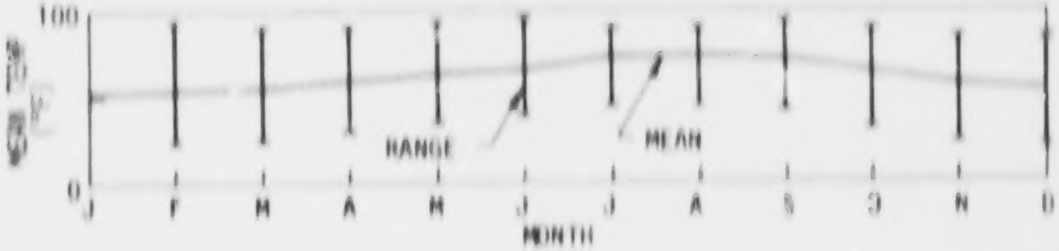
Monitors eight locations continuously as per California Noise Standards (NEL, CNEL, SENEL, dBA). Remote sites are pole-mounted Chesapeake microphones with signal conditioning and digital computation of dBA 2/sec. Transmission is FSK (1070-1270 Hz) of dB value. Single range covers 40-140 dBA. Calibration is by hand-held pistonphone and electrical insert commanded from airport. Raw acoustic signal compressed and sent on second telephone line for aural monitoring at airport. Central monitor is 8K minicomputer which logs hourly, daily, and violations levels. Tower conversations ±10 minutes of violation time are tape recorded. Software and hardware screening used to eliminate non-aircraft noise. Acoustic tracking used to sense traffic pattern direction and set violation limits.

NOTES

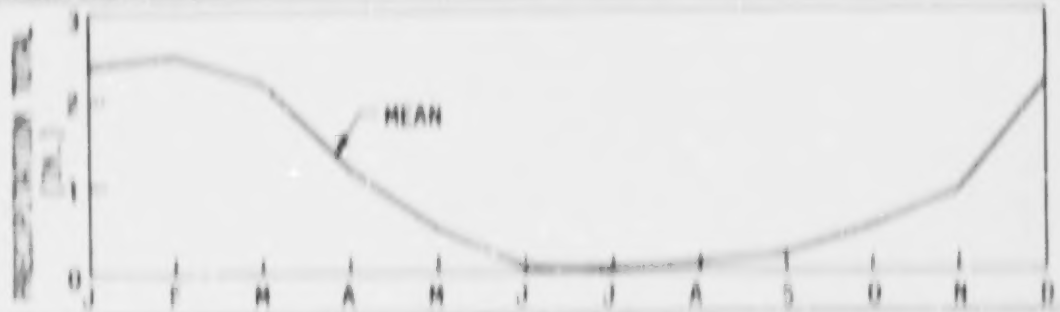
(1) Curfew between 11 p.m. and 6 a.m. being considered for jet aircraft.

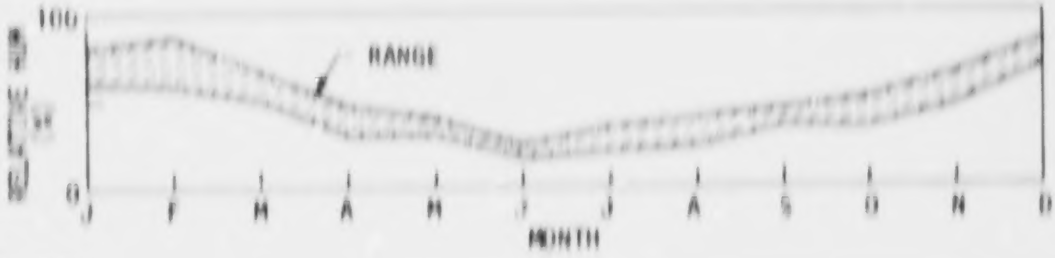
Table IV. Airport Typical Weather Conditions

WEATHER MEASUREMENTS AT AIRPORT U.S. Department of Commerce Weather Service Station	TEMPERATURE 62°F yearly mean HUMIDITY 50% yearly mean WIND 10 knots yearly mean RAINFALL 13 inches yearly mean

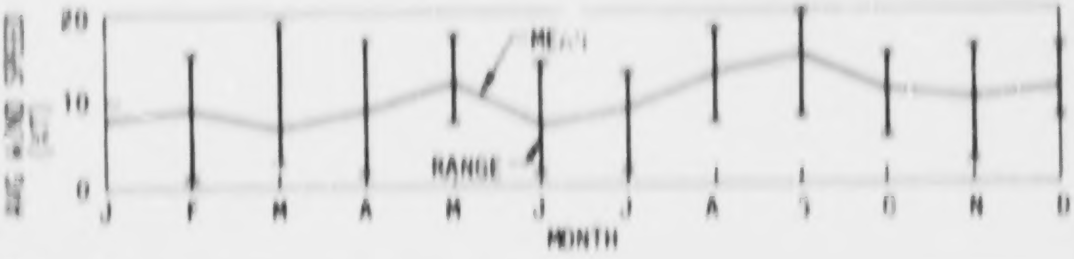


TEMPERATURE





HUMIDITY



WIND

Table V. Total System Performance

NOISE STANDARD, LAW, REGULATION GOVERNING SYSTEM DESIGN

See attached copy of California Noise Standards

UNIT OF NOISE MEASUREMENT

Time integrated dBA above a threshold - CNEL, HNL, SENEL

RANGE AND RESOLUTION OF NOISE THRESHOLD SETTING

55 to 70 dBA, in 1-dB steps

VIOLATION DETERMINATION

Integrated dBA above a violation threshold of single event - SENEL

VIOLATION THRESHOLD RANGE AND RESOLUTION

Noise levels of 60 to 90 dBA, in 1-dBA steps

VIOLATION LIMIT RANGE AND RESOLUTION

Noise exposure levels of 85 to 125 dBA, in 1-dB steps

ON-LINE/OFF-LINE DATA AVAILABILITY On line	PERCENT UTILIZATION OF SYSTEM Continuous
TIME TO INSTALL OR ACTIVATE SITE Not applicable	WEATHER REQUIREMENT AT SITE All-weather operation
DATA USAGE ☒ LITIGATION INVOLVING NOISE LEVELS ☐ PHYSICAL ACOUSTICAL RESEARCH ☒ COMMUNITY RESPONSE ☐ AIRPORT PLANNING ☐ CERTIFICATION OF AIRCRAFT	DATA REVIEWED BY: ☒ AIRPORT OPERATOR ☒ CITY, COUNTY ☒ STATE ☐ FEDERAL ☐ ACOUSTICAL CONSULTANT ☐ ENVIRONMENTAL GROUPS ☐ AIRCRAFT OPERATORS

TOTAL SYSTEM ACCURACY ±1.2 dBA	SYSTEM RESOLUTION 0.375 dBA	SYSTEM RANGE 40-140 dBA

SYSTEM OPTIONS EXPANDABILITY

Provision included for later expansion to 15 sites

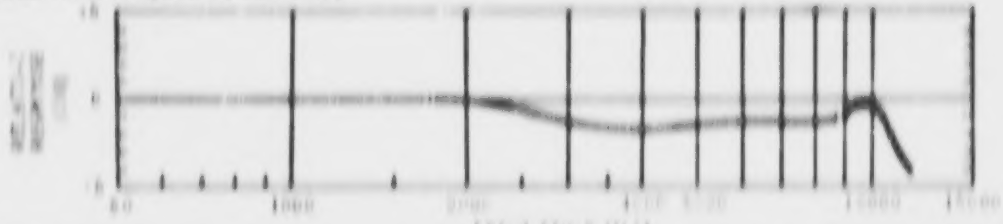
Table VI. Remote Sites – Acoustic Sensors

TYPE
Chesapeake NM 137A

NUMBER
8

INSTALLATION
Pole-mounted, 20-ft min. and 10-ft above obstructions

INSTALLATION FREQUENCY RESPONSE



LINEARITY
±0.25 dB

TEMP COEFFICIENT
0.1%/°F

PRESSURE COEFFICIENT
-

HUMIDITY COEFFICIENT
Not applicable

WINDSCREEN
Polyfoam sphere

BIRD PROTECTION
Nylon spike

LIGHTNING PROTECTION
None

PREAMP GAIN
36 dB

SELF NOISE LEVEL OF MIC PREAMP
10 dBA

PHOTO

NOTES

① Acoustical axis vertical; vibration damping isolator mount.

② Directivity pattern spherical within 3 dB.

③ Temperature range of operation -50°C to 150°C.

Table VII. Remote Sites - Equipment

SIGNAL CONDITIONING
A-weighting network - special network to detect aircraft noise ①

GAIN RANGES
Single range 40-140 dBA

GAIN SELECTION
N/A

DETECTION Slow responding A-weighting implemented using analog/digital converter and digital processing

RMS - LOG CONVERSION
Digital computation

MODEM
Frequency shift keying 1070-1270 Hz

SAMPLE RATE	**MESSAGE CONTENT**
2/sec	8 data bits + 4 status bits + 1 parity + 1 sync

ACOUSTIC CALIBRATION
Hand-held pistonphone placed on mic

INSERT CALIBRATION
1 kHz inserted at mic equal to 130 dBA - on command from central

ACTUAL MONITORING
Raw signal compressed and sent on separate channel 300-3000 Hz bandwidth

REMOTE CONTROLLABLE FUNCTIONS
Insert calibration activated by 800 Hz control tone

SIZE	**WEIGHT**	**TEMP RANGE**
10" x 12" x 8"	20 lb	20°F to 120°F
CONSTRUCTION	**POWER REQUIREMENTS**	**TIME OF UNATTENDED OPERATION**
Replaceable PC cds	10 watts	Unlimited

COMMUNICATION
Telephone handsets use actual monitoring channel

PHOTO

NOTES

① Narrow filter at 400 Hz with detector, time constant, limiters, and threshold discriminate against cars, trucks, voices, birds, insects, dogs, etc.

② Status bits
1 - non aircraft ①
2 - cal/no cal
3 - on line/off line
4 - spare

Table VIII. Transmission Link

TYPE Voice grade telephone line	
CHANNELS PER SITE 2 half duplex	
PATH LENGTHS 6-10 miles through two exchanges	
TRANSMISSION POWER LEVEL 0 dBM into 600 ohms	
FREQUENCY RESPONSE OF CHANNEL 300-3000 Hz	
DYNAMIC RANGE 30 dB maximum with frequent noise burst 20 dB down	
MODEM Freq shift keying	
MESSAGE RATE 2/second	BIT RATE 32/second
MESSAGE CONTENT 14 bits self-clocking pulse width code	
ERROR DETECTION Sync bit, number bits per message, odd parity	
ERROR CORRECTION None in transmission - see data handling	
MESSAGE FORMAT	

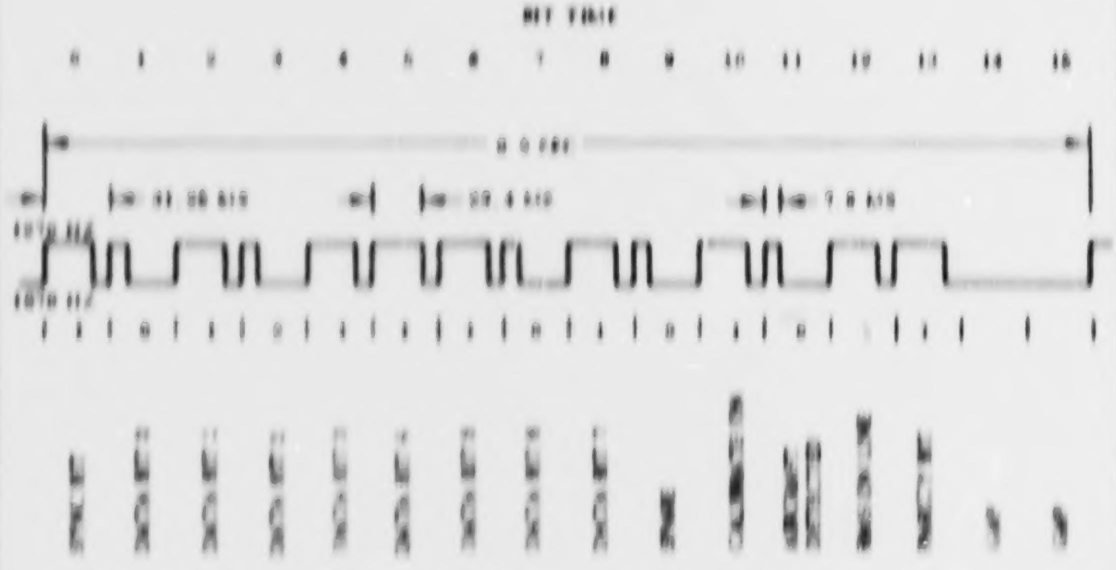

BIT TIME
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
0.5 SEC
31.25 MS
23.4 MS
7.8 MS
1270 HZ
1070 HZ

Table IX. Central Data Processing and Display

TYPE OF PROCESSOR

16-bit general purpose digital computer, Varian 620-L/100

SUBSYSTEMS AND EQUIPMENT CONFIGURATION

1. 8192-word core memory
2. Power fail/restart
3. Eight priority interrupts
4. Real time clock
5. Texas Instrument teleprinter
6. Two Texas Instrument digital tape cassettes
7. Eight telephone modem couplers
8. Tower radio tape recorder

DISPLAYS, ALARMS, MONITORS

1. Panel meters for continuous NL at site
2. Sonalert sound alarm for violations
3. Audio monitor of selected site
4. Teleprinter messages and alarms to operator (2)
5. Site status indicator map (1)
6. Date and time display

NO. REMOTE SITES

8

PROVISION FOR NEW SITES

7

SIZE

6' x 2' x 2'

WEIGHT

400 lb

POWER

800 watts

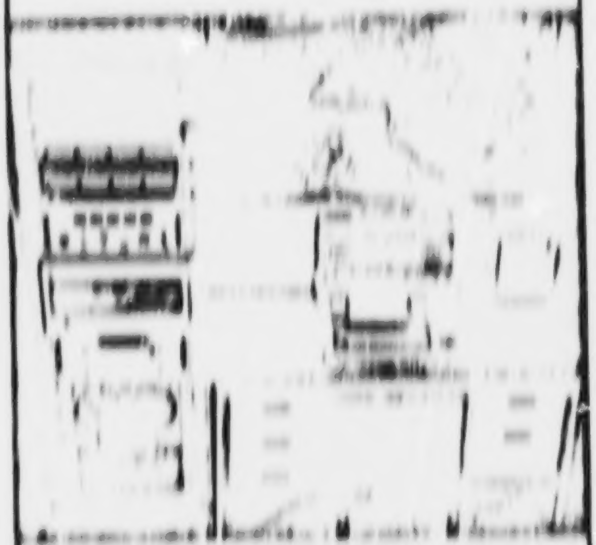
TEMP RANGE

40°F - 110°F

TIME OF UNATTENDED OPERATION

100 hours for teleprinter paper

PHOTO



LOGS

1. Hourly log of HNL for sites
2. Daily log of CNEL for sites
3. Daily calibration of sites
4. Violation levels and time for violation
5. Daily status and status change summary
6. Daily summary of violations

NOTES

1) Map status indicator code:

Steady red light - out of service
Steady grn light - in service, no aircraft
Alternating red/grn - aircraft violation
Blinking grn light - aircraft noise being accumulated

2) Teleprinter messages:

SENEL violation
Interruption of power
Excessive transmission errors
Change in on-line/off-line site status
Change in duty runway
Post-violation calibration check result
SENEL levels for non-violation aircraft

Table X. Central Processing Software

NUMBER WORDS OF PROGRAM 4510	NUMBER WORDS OF DATA 3670
NUMBER WORDS SPARE 12	PEAK PERCENTAGE UTILIZATION OF COMPUTER 20% of maximum
METHOD OF LOADING PROGRAM Digital tape cassette NUMBER OF OPERATOR INPUTS 21 optional commands 2 computer switch settings	PROVISIONS FOR ERROR MESSAGES a. Operator inputs slashed if erroneous b. Time flagged in error after power failures

The 21 operator commands are two-letter mnemonic commands, with trailing numeric parameters where appropriate. They permit assignment of remote sites to HNL and/or SENEL monitoring tasks, adjustment of noise level thresholds and noise exposure level limits, control of the tape recorder, entry of date and time, execution of calibration checks, reprinting of various reports, and insertion of the duty runway (an override option). Once initial entries have been made, no operator intervention is required except to reset the time after a power failure.

One computer switch permits optimal printing of noise exposure level for non-violation aircraft; the other temporarily delays message output while the printer is off-line (as when paper is replaced).

Table XI. Tracking

TYPE None used at Lindbergh Field(1)		
RANGE COVERAGE	RANGE ACCURACY	RANGE RATE
BEARING COVERAGE	BEARING ACCURACY	BEARING RATE
ALTITUDE COVERAGE	ALTITUDE ACCURACY	ALTITUDE RATE
NUMBER TRACKING SITES	LOCATION	
ACTIVE/PASSIVE TARGETS	TRANSPONDER OR BEACON	
ANALOG/DIGITAL RECORDING OF DATA	REAL TIME PLOT OF TARGET	PLOT SCALE
RECORDED DATA ACCURACY	OFF LINE PROCESSING TURNAROUND TIME	PLOT ACCURACY
PROCESSED PLOT OF TARGET	PROCESSED PLOT SCALE	PROCESSED ACCURACY
LINE PRINTER PARAMETERS LISTED		
RATE PARAMETERS ARE LISTED ON LINE PRINTER		
PHOTO	NOTES (1) Sequence in which acoustic level exceeds thresholds at sites is used to determine runway direction in use.	

Table XII. System Cost/Schedule

<table>
<tr><td colspan="2">DESIGN COST
*</td><td colspan="2">DESIGN MAN MONTHS
*</td><td colspan="2">DESIGN PERIOD
4 months</td></tr>
<tr><td colspan="2">PROCUREMENT COST
$124,000</td><td colspan="2">PROCUREMENT MAN MONTHS
*</td><td colspan="2">PROCUREMENT PERIOD
3 months</td></tr>
<tr><td colspan="2">SYSTEM COST INSTALLED
$120,000</td><td colspan="2">MANUFACTURE MAN MONTHS
*</td><td colspan="2">MANUFACTURE PERIOD
4 months</td></tr>
<tr><td colspan="3">YEARLY MAINTENANCE COST
$4,000</td><td colspan="3">RENTAL LEASE COST PER YEAR
*</td></tr>
<tr><td colspan="3">OPERATIONS COST
*</td><td colspan="3">LIFE EXPECTANCY
20 years</td></tr>
<tr><td colspan="3">CURRENT REPLACEMENT COST
$140,000</td><td colspan="3" rowspan="2"></td></tr>
<tr><td colspan="3">PERSONNEL REQUIREMENTS IN NUMBER PEOPLE AND MAN HOURS PER YEAR
MAINTENANCE 1 MAN HOURS 240
OPERATION 1 MAN HOURS 300
DATA REVIEW 1 MAN HOURS 300</td></tr>
</table>

Table XIII. Central Processing Unit Block Diagram

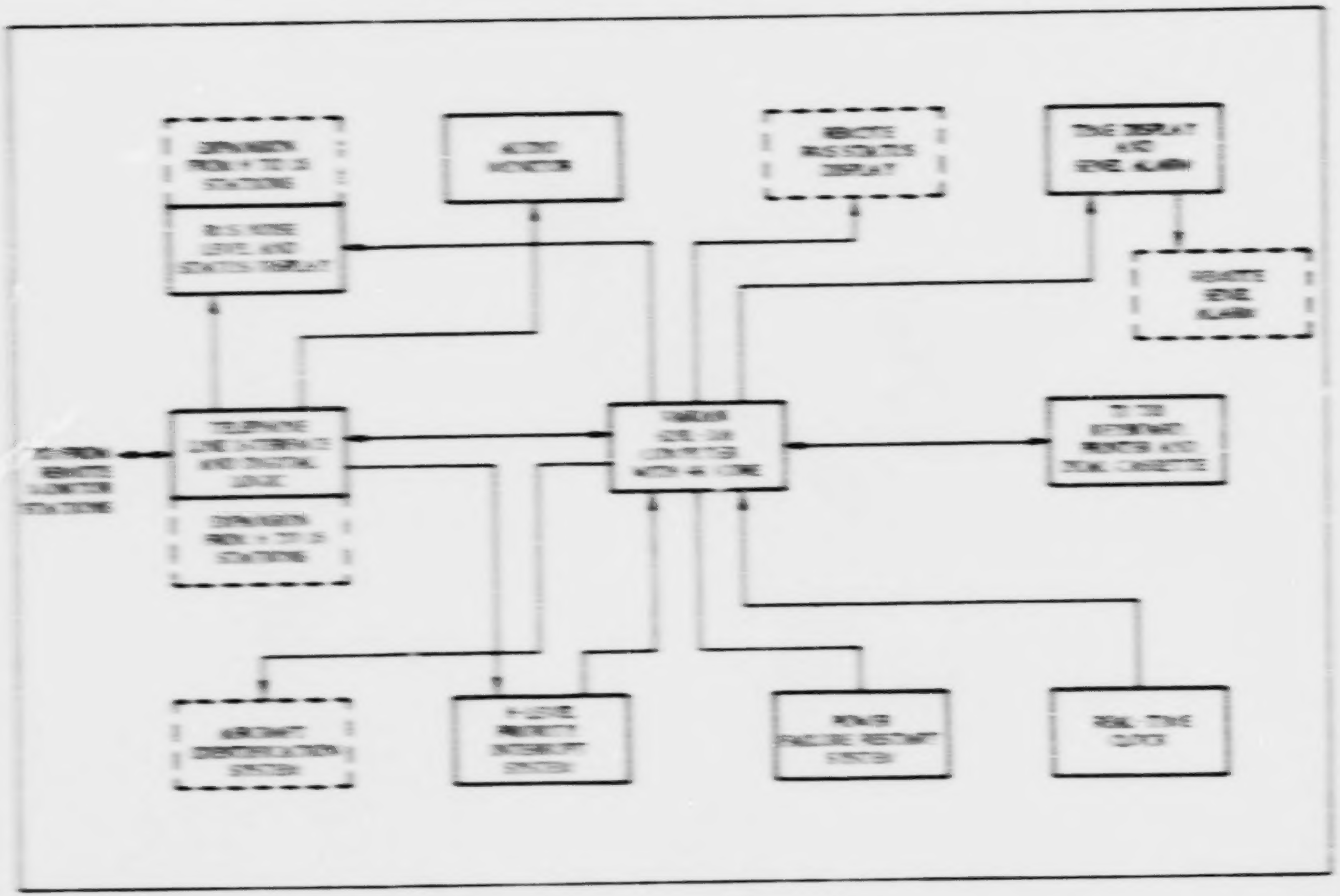

EXPANSION FROM 4 TO 15 STATIONS
AUDIO MONITOR
REMOTE NMS STATUS DISPLAY
TIME DISPLAY AND SENEL ALARM
NOISE LEVEL AND STATUS DISPLAY
REMOTE SENEL ALARM
TO/FROM REMOTE MONITOR STATIONS
TELEPHONE LINE INTERFACE AND DIGITAL LOGIC
VARIAN 620L-100 COMPUTER WITH 4K CORE
KEYBOARD PRINTER AND DUAL CASSETTE
EXPANSION FROM 4 TO 15 STATIONS
AIRCRAFT IDENTIFICATION SYSTEM
4-LEVEL PRIORITY INTERRUPT SYSTEM
POWER FAILURE RESTART SYSTEM
REAL-TIME CLOCK

Table XVI. Remote Site Block Diagram

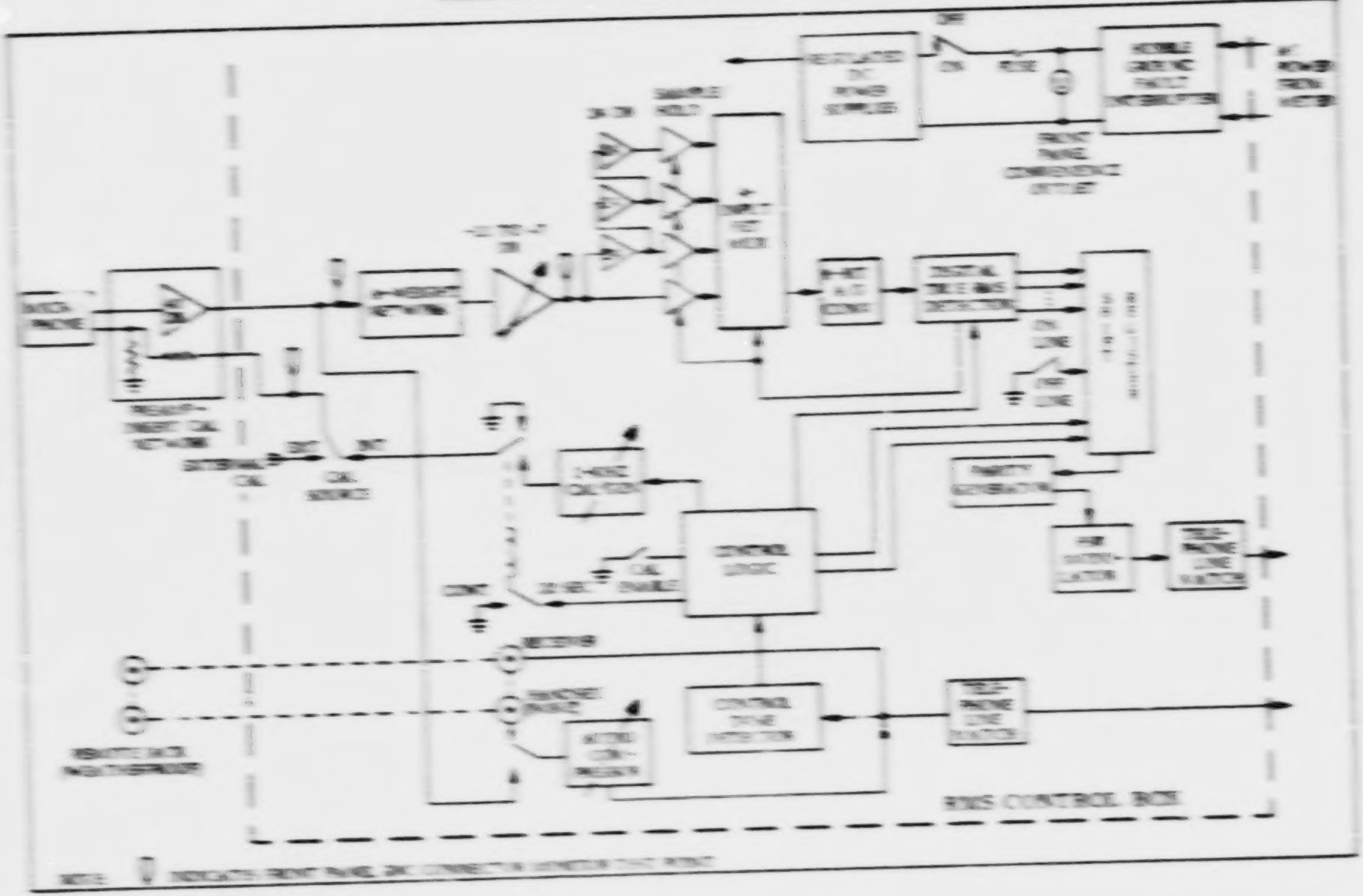
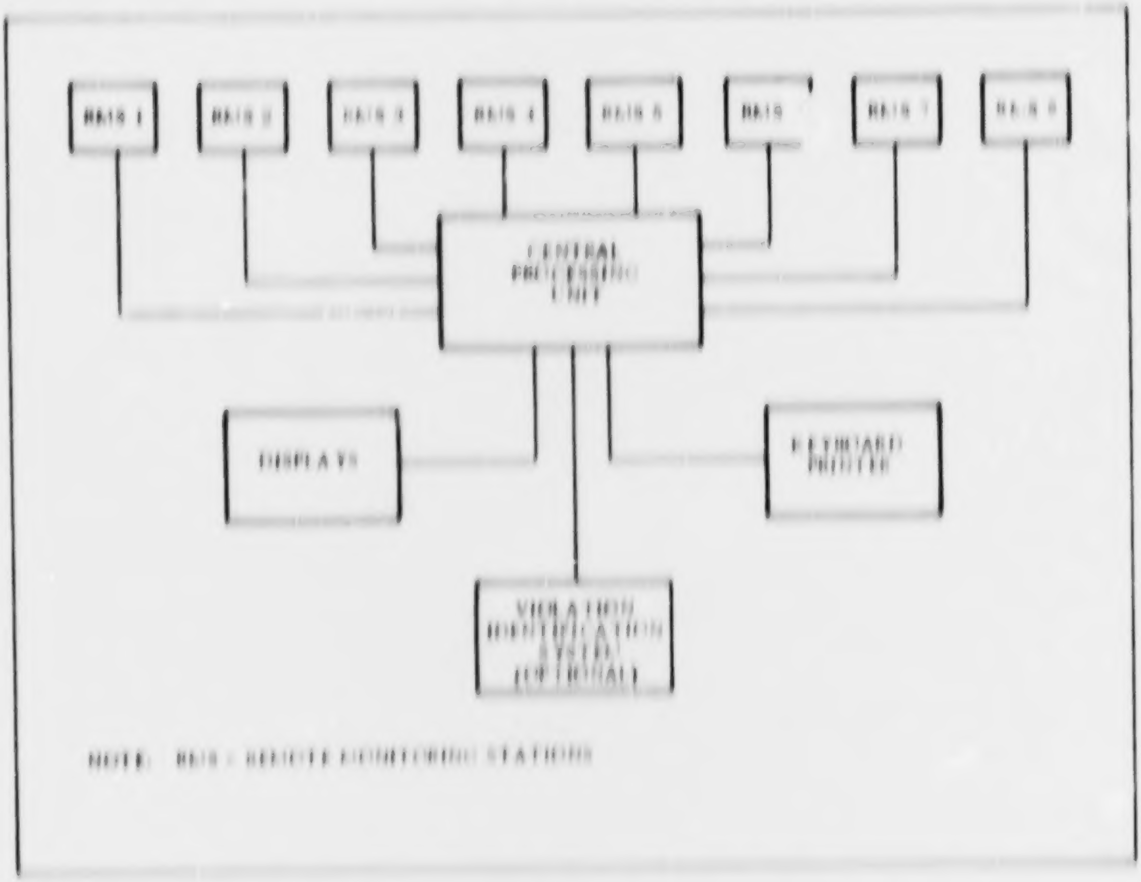

MICRO-PHONE
PREAMP-INSERT CAL NETWORK
A-WEIGHT NETWORK
+12 TO -7 DB
24 DB
SAMPLE HOLD
4 INPUT MUX
8-BIT A/D CONV
DIGITAL TRUE RMS DETECTOR
ON LINE
OFF LINE
PARITY GENERATOR
FSK OSCIL-LATOR
TELE-PHONE LINE MATCH
REGULATED DC POWER SUPPLIES
OFF
ON
FUSE
FRONT PANEL CONVENIENCE OUTLET
MOBILE GROUND FAULT INTERRUPTER
AC POWER FROM METER
EXTERNAL CAL
INT
EXT
CAL SOURCE
1-KHZ CAL SIGNAL
CAL ENABLE
15 SEC
CONT
CONTROL LOGIC
RECEIVER
HANDSET PHONE
AUDIO CON-VERTER
CONTROL TONE DETECTOR
TELE-PHONE LINE MATCH
REMOTE JACK WEATHERPROOF
RMS CONTROL BOX
NOTE: INDICATES FRONT PANEL BNC CONNECTOR MONITOR TEST POINT

Table XV. Overall System Block Diagram


RMS 1
RMS 2
RMS 3
RMS 4
RMS 5
RMS
RMS 7
RMS 8
CENTRAL
PROCESSING
UNIT
DISPLAYS
KEYBOARD
PRINTER
VIOLATION
IDENTIFICATION
SYSTEM
(OPTIONAL)
NOTE: RMS = REMOTE MONITORING STATIONS

Section 2

SURVEY REPLIES

The following material represents the replies received to date as a result of the survey letters. The information is given in the following order:

2.1 Oakland International Airport
2.2 Orange County Airport
2.3 San Jose Airport
2.4 Munich Airport
2.5 San Diego Lindbergh Field
2.6 Hewlett-Packard Gmbh
2.7 B&K Instruments
2.8 Tracor, Inc.
2.9 General Radio
2.10 Hewlett-Packard Palo Alto
2.11 The Port Authority of New York and New Jersey
2.12 Stuttgart Airport, West Germany
2.13 Schiphol Airport, Amsterdam
2.14 Frankfurt, Germany
2.15 Rhode and Schwarz

2.1 OAKLAND INTERNATIONAL AIRPORT

PORT OF OAKLAND

BOARD OF PORT COMMISSIONERS
CITY OF OAKLAND
[illegible] President
ROBERT E. MORTENSEN 1st Vice President
WILLIAM WALTERS 2nd Vice President
THOMAS L. BERKLEY Commissioner
[illegible] Commissioner
[illegible] Commissioner
PETER M. TRIPP Commissioner
BEN E. NUTTER Executive Director

July 30, 1974

Mrs. Carole S. Tanner
Project Engineer
Hydrospace-Challenger, Inc.
1360 Rosecrans Street
San Diego, California 92106

Dear Mrs. Tanner:

Per our telecon of July 26, herewith is the report on noise monitoring at the Oakland International Airport.

An addendum to this report gives a description of the noise monitoring system and lists the specific sensors and measuring instruments employed.

Hope this material will be adequate to your project studies for EPA.

Sincerely,

Ellis J. Gabbay

Ellis J. Gabbay
Airport Acoustical Engineer

EG
Enclosures

66 Jack London Square • P.O. Box 2064 • Oakland, California 94607 • Phone (415) 444-5188
Cable Address PORTOFOAK, Oakland • Telex 336-334

MEMBER: THE AMERICAN ASSOCIATION OF PORT AUTHORITIES, INC.; THE AIRPORT OPERATORS COUNCIL INTERNATIONAL, INC.
AND THE INTERNATIONAL ASSOCIATION OF PORTS AND HARBORS

PORT OF OAKLAND

CITY OF OAKLAND
[illegible]

July 25, 1973

Honorable Loren W. Enoch
Administrator, Alameda County
1221 Oak Street
Oakland, California 94612

Dear Mr. Enoch:

Noise Monitoring for the Oakland International Airport - Report No. 1

At their meeting of June 13, 1972, the County Board of Supervisors designated Oakland International Airport as having a noise problem. Therefore, in compliance with the State Noise Regulations, it was required to measure noise levels and determine noise impact boundaries resulting from airport operations.

The task of setting up a satisfactory noise monitoring system which would implement the intents and accuracy requirements of the State Noise Regulations, was closely coordinated with the responsible technical authority of the State Department of Aeronautics. The resulting noise monitoring system became operational for the necessary "intermittant" noise monitoring function, in April 1973, at which time formal data aquisition was commenced. A descriptive note of the Port of Oakland noise monitoring system is attached hereto for your reference.

At this time we are pleased to submit data obtained during the first season of monitoring, covering the period of the 1973 spring quarter.

The enclosures listed below cover the several reporting requirements specified in Section 5050 (e) of the State Noise Regulations.

(1) Representation of the Airport 80 CNEL contour (approximating present average noise levels of Airport operations) on an aerial photo plan of the area to a scale of one inch to 2,000 feet.

(2) Plan of the Airport to a scale of one inch to 1,000 feet showing the locations of No. 1 and No. 2 noise monitoring points. Also delineation of a boundary line on Bay Farm Island which is just outside the 80 CNEL contour, as determined from the monitoring data thus far acquired.

66 Jack London Square • P.O. Box [illegible] • Oakland, California [illegible] • Phone (415) [illegible]
Cable Address PORTOFOAK, Oakland • Telex [illegible]

(3) a. Tabulation of the integrated hourly noise levels measured at Sites No. 1 and No. 2 during the seven consecutive days of monitoring required at each of the locations. Also computed daily and weekly average CNEL's.

b. Summary of aircraft operations on Runway 29-11 during the period of records.

For the type of monitoring approved by the State Department of Aeronautics for the Oakland International Airport, the above listed enclosures comprise the total reporting material required from the Port of Oakland, under Section 5050 Paragraphs (e) and (f) of the State Noise Regulations.

By way of explanation of these enclosures we further comment as follows:

(i) Until January 1, 1976, the criterion CNEL which has to be validated by monitoring, for compatible land uses, and zero noise impact boundary, is the 80 CNEL noise contour line. There is no requirement to monitor elsewhere and specifically outside of this contour.

(ii) Single event noise monitoring off Runway 29-11 is not required, because the approach and departure paths at either end are over water (Section 5024 of the Noise Regulations).

(iii) Single event monitoring for either ends of the three general aviation runways 27L, 27R and 15, are omitted by virtue of Section 5031 of the Noise Regulations.

(iv) In consequence of (ii) and (iii) above, the reporting of single event noise violations, (if any), is not a requirement.

(v) It may be noted from the delineated boundary line on Item (2), the noise impact area on Bay Farm Island from Airport operations is "Zero" as required by Section 5062 of the Noise Regulations. Other interior areas of the 80 CNEL contour, are either on Airport property or over water.

Finally it is desired to point out that measured CNEL values are interim results relevant to the spring season only. For CNEL contour validation, it is necessary to determine an annual average CNEL at each of the monitoring locations. Acquisition of necessary data for this task will not be completed until March 21, 1974.

We trust the above information meets your requirements for the necessary reporting to the State of California.

Yours truly,

E J Gallag

Ellis J. [illegible]
Airport Acoustical Engineer

EJG:pt
Enclosures

July 10, 1973

OAKLAND INTERNATIONAL AIRPORT

Summary of Aircraft Operations
Runway 29-11

Period of Record - March 21 thru June 21, 1973

Total operations including helicopters	25,144
Helicopters only (estimated)	4,600
Estimated total of highest noise level aircraft class*	3,770

*Comprised by the categories of aircraft listed for Curve "A" of Figure 3A of the State Department of Aeronautics Noise Standards.

DATE : JULY 10, 1973

PORT OF OAKLAND
NOISE MONITORING DATA

SITE NO. 1

WEEK OF APRIL 14 THRU 20, 1973

TABULATION OF HOURLY NOISE LEVELS (HNL : dB)

HOUR OF DAY \ DAY OF WEEK	SAT 4/14	SUN 4/15	MON 4/16	TUE 4/17	WED 4/18	THU 4/19	FRI 4/20
0000 - 0100	70.49	70.99	60.00	60.00	71.17	67.95	70.49
0100 - 0200	70.87	69.56	67.64	60.99	60.00	60.00	60.00
0200 - 0300	70.48	60.00	71.30	60.00	60.00	60.00	60.00
0300 - 0400	60.00	60.00	60.00	63.79	60.00	60.00	60.00
0400 - 0500	60.00	60.00	60.00	72.73	60.00	60.00	67.87
0500 - 0600	64.16	60.00	60.00	60.00	60.00	60.00	66.20
0600 - 0700	70.05	60.00	66.77	71.97	63.15	65.01	64.35
0700 - 0800	77.65	71.05	74.17	70.75	71.11	74.56	72.75
0800 - 0900	77.85	70.95	70.71	70.97	70.16	70.81	73.00
0900 - 1000	72.15	70.65	73.00	74.00	67.10	70.17	66.11
1000 - 1100	73.70	72.90	73.54	70.74	74.40	70.64	71.84
1100 - 1200	80.91	71.49	71.05	74.96	69.16	70.75	72.51
1200 - 1300	71.84	71.84	70.17	72.15	71.91	71.65	70.95
1300 - 1400	70.13	72.49	73.00	70.55	71.81	72.40	71.09
1400 - 1500	70.61	60.91	73.81	77.60	72.14	71.69	70.05
1500 - 1600	67.90	70.65	71.97	70.70	71.73	68.19	69.15
1600 - 1700	72.70	70.81	72.06	70.91	70.59	71.17	68.00
1700 - 1800	69.71	72.05	70.15	74.87	74.70	71.70	68.90
1800 - 1900	70.80	72.80	70.40	77.06	72.01	68.85	70.90
1900 - 2000	69.91	77.10	70.51	79.00	73.65	71.10	70.00
2000 - 2100	72.47	74.80	71.80	73.85	70.81	70.01	69.09
2100 - 2200	70.15	70.11	71.92	70.70	61.85	74.71	69.02
2200 - 2300	69.90	71.58	70.14	70.57	70.05	77.44	70.41
2300 - 2400	73.91	70.05	72.49	79.06	72.05	70.19	71.91

	SAT	SUN	MON	TUE	WED	THU	FRI
DAILY CNEL'S	80.42	77.90	75.91	81.10	78.97	77.05	76.77
CUMULATIVE AVERAGE 7-DAY CNEL	78.78						

NOTE : The monitoring microphone was mounted [illegible] above ground [illegible]
[illegible] [illegible]

DATE JULY 17, 1978

PORT OF OAKLAND
NOISE MONITORING DATA

SITE NO. 2

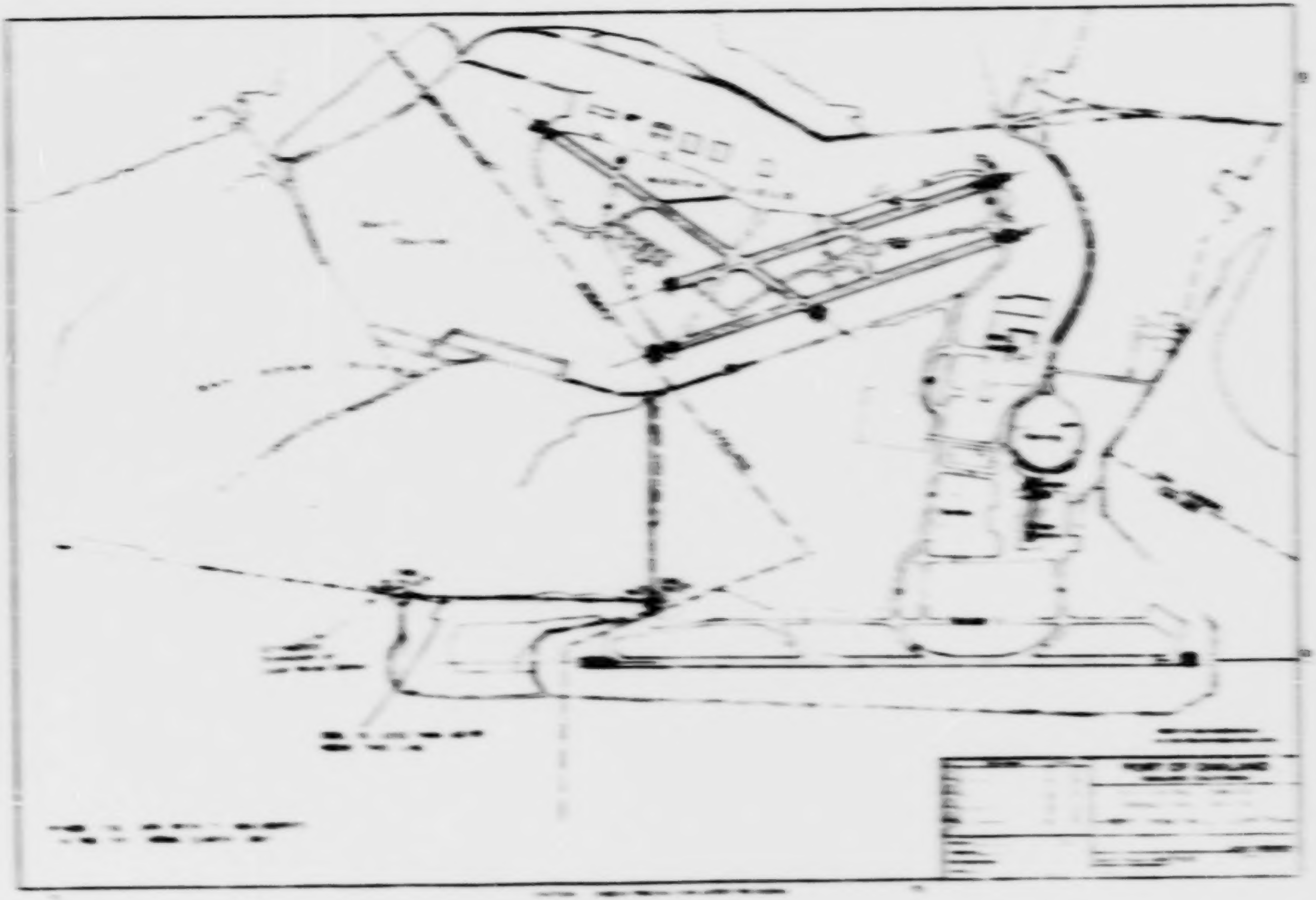
WEEK OF MAY 16 THRU 22 1978

TABULATION OF HOURLY NOISE LEVELS (HNL - dB)

HOUR OF DAY / DAY OF WEEK	WED 5-16	THU 5-17	FRI 5-18	SAT 5-19	SUN 5-20	MON 5-21	TUE 5-22
0000 - 0100	60.00	74.77	60.12	65.57	60.00	62.40	67.02
0100 - 0200	60.00	64.22	60.00	60.00	60.00	60.00	61.01
0200 - 0300	60.00	60.00	60.00	68.17	70.71	69.05	71.14
0300 - 0400	60.00	60.00	60.00	60.00	73.10	60.00	62.16
0400 - 0500	60.00	60.00	60.00	60.00	60.00	60.00	60.00
0500 - 0600	60.00	60.00	60.00	60.00	61.97	60.00	60.00
0600 - 0700	60.00	67.50	60.00	60.00	68.15	71.15	60.00
0700 - 0800	73.52	71.96	70.46	73.10	70.80	70.15	70.81
0800 - 0900	72.06	70.29	71.22	77.19	70.41	72.76	70.13
0900 - 1000	66.10	70.40	60.01	72.61	71.20	69.11	65.90
1000 - 1100	60.01	69.90	72.90	70.95	72.52	68.96	70.11
1100 - 1200	67.79	68.04	67.05	70.00	71.00	67.96	70.50
1200 - 1300	70.44	68.26	74.81	72.72	68.12	73.01	70.06
1300 - 1400	70.76	71.10	70.20	70.07	73.51	73.17	72.63
1400 - 1500	71.06	70.75	70.75	71.00	74.29	72.05	69.59
1500 - 1600	60.02	71.00	71.94	70.93	60.00	60.71	71.90
1600 - 1700	60.70	71.93	67.01	71.83	72.50	73.10	74.02
1700 - 1800	69.41	68.00	71.06	71.99	72.10	72.91	74.19
1800 - 1900	70.91	72.95	71.51	73.00	78.15	69.67	70.97
1900 - 2000	71.47	68.92	70.10	70.10	70.11	71.00	70.10
2000 - 2100	72.02	68.79	68.15	69.02	74.20	71.85	70.70
2100 - 2200	72.96	68.21	67.00	71.57	70.00	72.22	69.24
2200 - 2300	70.94	64.47	60.00	63.10	71.07	60.05	61.70
2300 - 2400	76.72	62.17	65.90	70.00	60.00	71.47	71.01

DAILY CNEL'S	77.18	74.50	73.42	70.95	76.26	73.14	75.40
CUMULATIVE WEEKLY AVG CNEL	75.88						

NOTE: The [illegible] microphone [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] of [illegible] [illegible] [illegible].



July 19, 1971

DESCRIPTION OF THE PORT OF OAKLAND'S NOISE MONITORING SYSTEM

The B&K manufactured system shown on Figure 1. consists of an omni-directional condenser microphone and pre-amplifier, having a frequency response from 22 Hz to 22 KHz coupled directly to a measuring amplifier where the signal is amplified, rectified and A-weighted by the appropriate filter network. An RMS audio signal is delivered to a potentiometric recorder which traces a time history of the noise signal. At this point, all peak dBA levels and their time of occurance can be identified, logged and matched to the appropriate flight events.

The recorder trace can also be either integrated directly for noise energy content or used to approximate this energy from the 10 dB down duration of each event. From this data the following computations can be carried out:

1. The single event noise equivalent level for each flight.
2. The logarithmically weighted hourly average of all single event equivalent levels to determine an hourly noise level (HNL).

The above computational routine is represented schematically on Figure 2. and is carried out using a programmable desk calculator. The data obtained can then be applied to generate the daily community noise equivalent levels (CNEL's) which are also logged for further processing into annual CNEL's.

A parallel procedure utilizes a statistical distribution analyser. This unit is attached (by an electrical link) to the pen of the potentiometric recorder. It samples the noise signal above a pre-set threshold in 2-1/2 or 5 dB slices according to choice. The statistical distribution analyser (SDA) adds up the residence times of the signal in each band. Twelve (12) separate registers in the SDA accumulate this data. If the SDA is pre-set for a 1-hour accumulation interval then the data can be applied directly to the calculation of the hourly noise levels. The formula and program for computation of hourly noise levels from SDA register data are presented on Figure 3.

Next the corresponding daily community noise equivalent levels (CNEL's) are computed (see Figure 2.) and by further processing the cumulative average "CNEL" for a specified period of seven days (or more), or on an annual basis, can also be computed.

The above described parallel procedures, that is of determining HNL's either from (1) SDA register counts or (2) single event integration and accumulation from recorder traces, provides an independent check on the integration process. More importantly, however, the single event accumulation feature enables separation of the overflight component noise from the noise generated directly by Airport operations. Such separation procedure becomes worthwhile at large sideline distances from the runway where overflight noise could be significant.

The system was calibrated and checked out to Section 5080.3 of the State of California Noise Standards using square wave signals (see Figures 4 and 5 showing the test setup). The overall accuracy was determined to be within the requirements of the State Noise Standards. A listing of the noise monitoring equipment is given on Table I. A listing of the test and calibration gear is given on Table II.

TABLE I

NOISE MONITORING COMPONENTS

ITEM	PART NUMBER
MICROPHONE (B & K)	4149
PRE-AMPLIFIER (B & K)	2619/S
DEHUMIDIFIER (B & K)	UA 0308
MEASURING AMPLIFIER (B & K)	2607
LEVEL RECORDER (B & K)	2305
LEVEL RECORDER POTENTIOMETER - 50 dB RANGE	
STATISTICAL DISTRIBUTION ANALYZER (B & K)	4420

TABLE II

AUXILIARY EQUIPMENT USED IN SYSTEM CALIBRATION AND CHECK OUT

ITEM	PART NUMBER
PISTON PHONE CALIBRATOR (B & K)	4220
SIGNAL GENERATOR (WAVE TEK) (SET AT 1-KC SINUSOIDAL SIGNAL)	131A
AGASTAT TIMING RELAYS	7012
MONROE PROGRAMMABLE CALCULATOR	1880
SECONDS STOPWATCH FOR RELAY TIMING CALIBRATION	
SYNCHRONOUS MOTOR FOR EVENT MARKER TIMING PULSES	

NOISE MONITORING SYSTEM

Block diagram of measurement and system

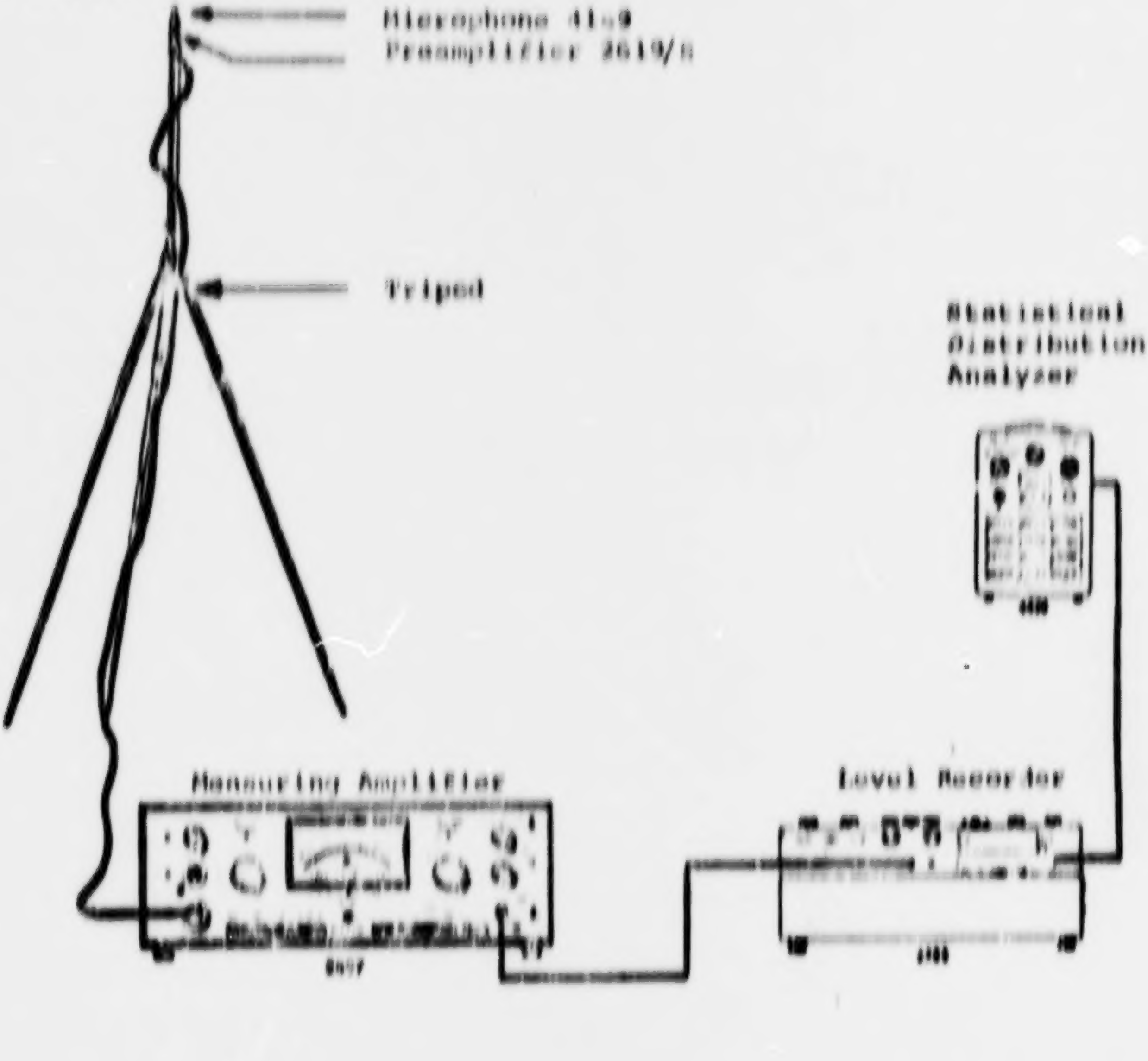
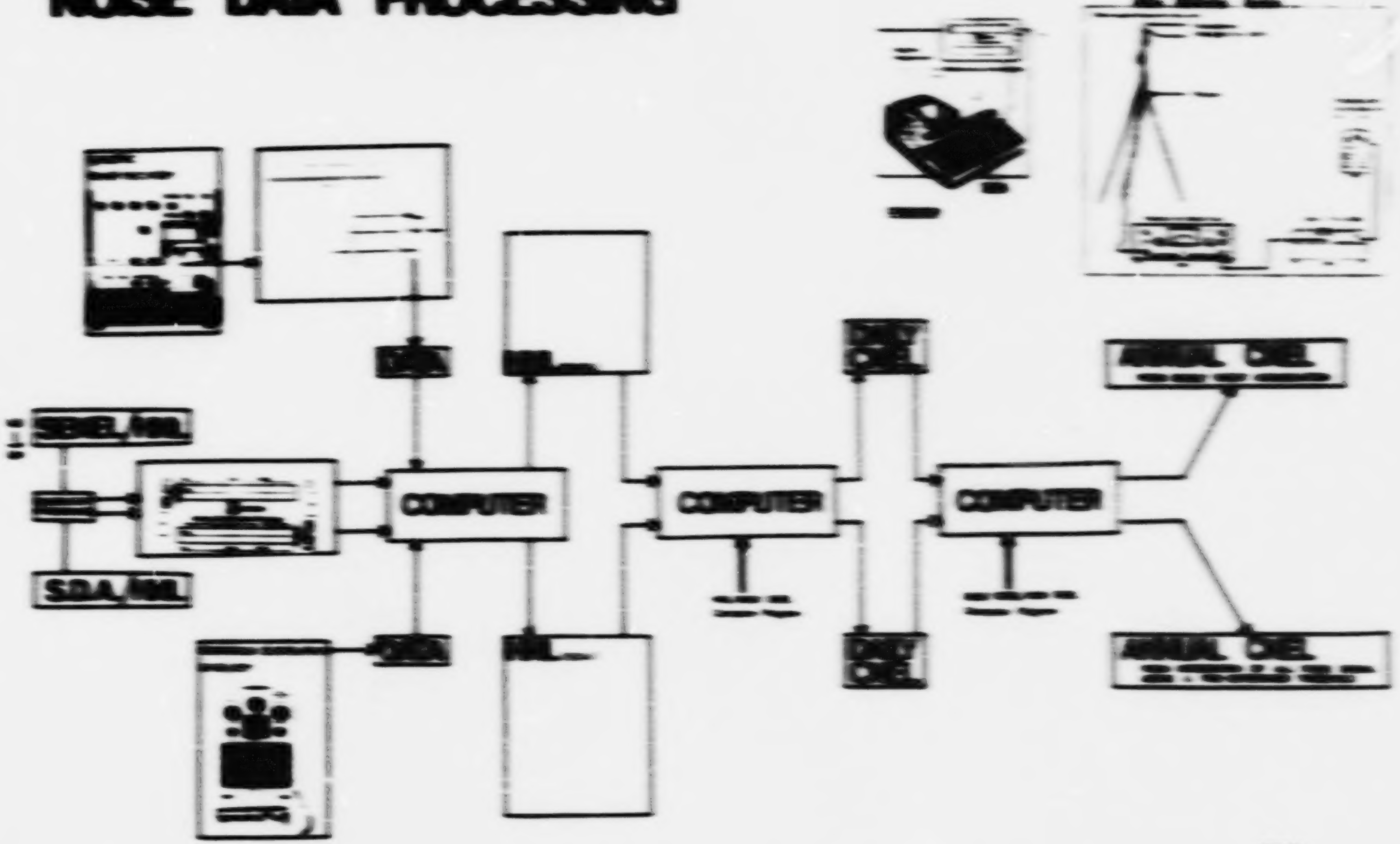

Microphone 4149
Preamplifier 2619/S
Tripod
Statistical Distribution Analyzer
4420
Measuring Amplifier
2607
Level Recorder
2305

FIG. 1

NOISE DATA PROCESSING


DATA
COMPUTER
COMPUTER
DAILY CNEL
DAILY CNEL
COMPUTER
ANNUAL CNEL
ANNUAL CNEL
DATA

MONROE 1880 PROGRAMMABLE CALCULATOR PROGRAM
FOR DETERMINATION OF HOURLY NOISE LEVELS (HNL'S)
FROM THE STATISTICAL DISTRIBUTION ANALYSER REGISTER COUNTS

FORMULA:

$$(HNL) = (M - P) + 10 \log_{10} \left(\frac{\sum_{j=1}^{j=12} K_j A_j t_j}{\sum_{j=1}^{j=12} t_j} \right)$$

M = MAXIMUM RECORD LEVEL

P = POTENTIOMETER RANGE

L = THRESHOLD LEVEL = (M − P)

t_j = COUNT OF SECONDS IN THE jTH REGISTER

$A_j = K_j \times 10^{P/100(j-1)}$, $K_j = 1$, FOR $2 \leq j \leq 11$, $K_j = 0$ ELSEWHERE.

COMPUTER PROGRAM LISTING

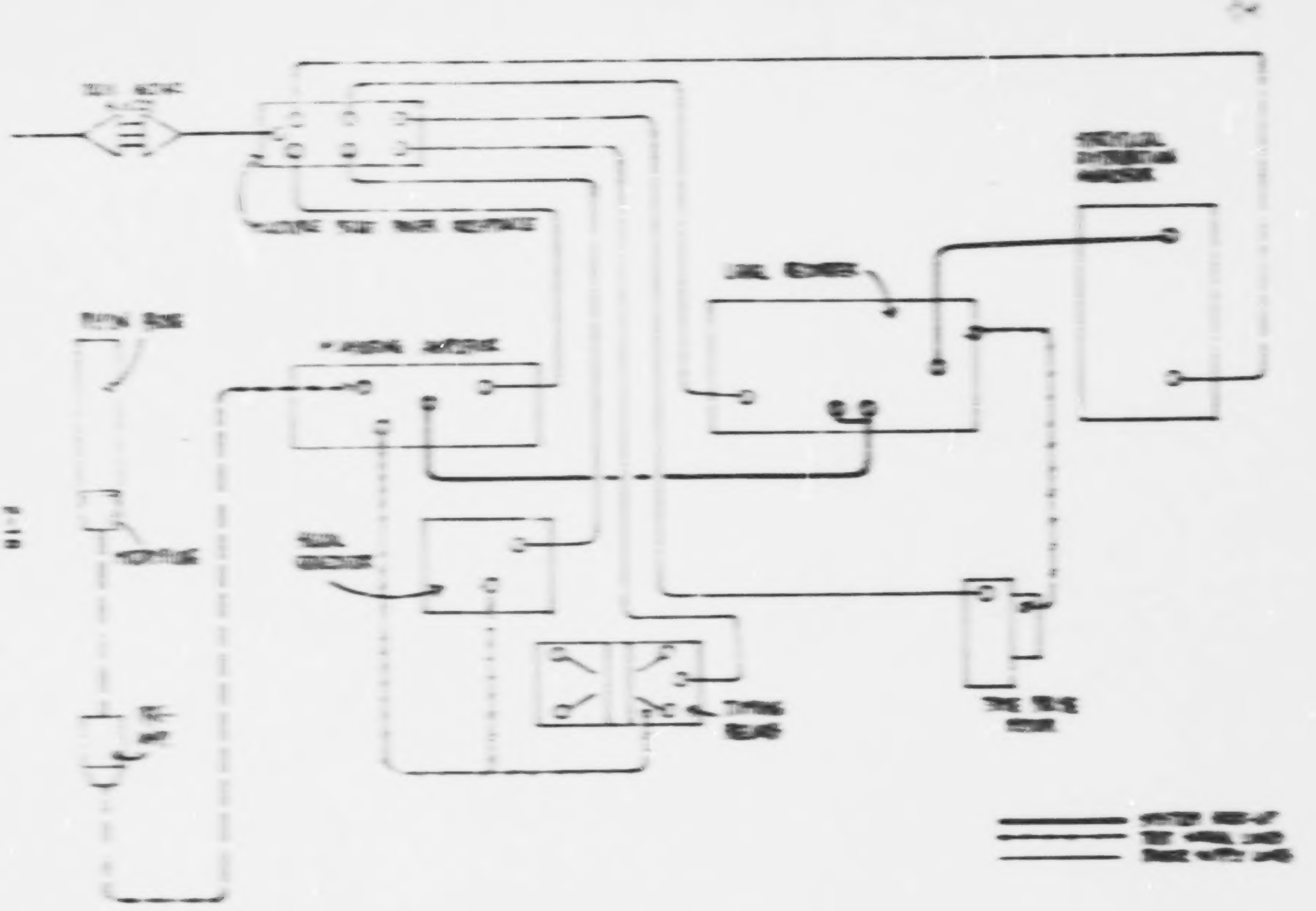
```
0000    066                 0010    056
   1    091    /               1    060
   2    065                    2    110    (
   3    065                    3    007        ÷
   4    069                    4    065
   5    069                    5    062    ∧
   6    056                    6    116      p
   7    060                    7    000        9
   8    110    (               8    032        2
   9    010     x              9    110    (
```

FIG. 5 (Page 1 of 2 Pages)

COMPUTER PROGRAM LISTING (CONTINUED)

```
                                         0060     111     |
0020     012                                1     012
   1     056                                2     022      -
   2     060                                3     001        1
   3     047     L                          4     002        2
   4     056                                5     020      =
   5     002        2                       6     126      M
   6     056                                7     020      =
   7     060                                8     067
   8     047     L                          9     001        1
   9     110     |                       0070     126      M
0030     011        9                       1     067
   1     111     |                          2     002        2
   2     012                                3     066
   3     022      -                         4     003        3
   4     026     (                          5     056
   5     003        3                       6     060
   6     024      +                         7     047     L
   7     002        2                       8     111     |
   8     027        )                       9     000        0
   9     023      X                      0080     024      +
0040     111     |                          1     111     |
   1     010        8                       2     002        2
   2     024      +                         3     061     A
   3     001        1                       4     020      =
   4     000        0                       5     050    G
   5     000        0                       6     052      F
   6     020      =                         7     023      X
   7     051    √                           8     001        1
   8     052      F                         9     000        0
   9     023      X                      0090     021      +
0050     111     |                          1     111     |
   1     011        9                       2     007        7
   2     020      =                         3     022      -
   3     110     |                          4     111     |
   4     021      +                         5     010        8
   5     000        0                       6     020      =
   6     001        1                       7     061     A
   7     110     |                          8     126      M
   8     021      +                         9     067
   9     013                             0100     001        1
```

FIG 3 (Page 2 of 7 Pages)

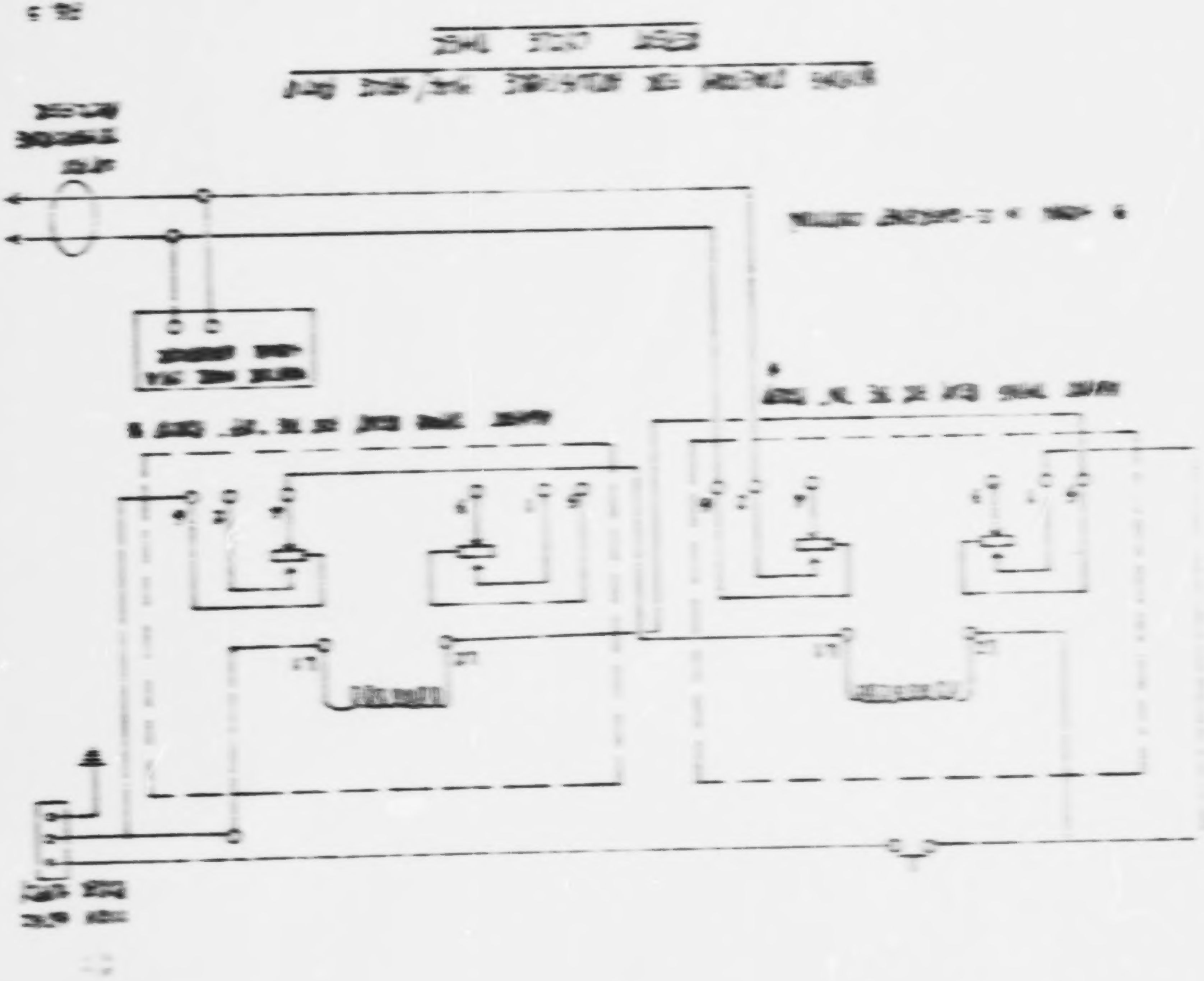


[illegible]

[illegible]

[illegible]

FIG. 4



2.7 ORANGE COUNTY AIRPORT

COUNTY OF ORANGE

ORANGE COUNTY AIRPORT

ROBERT J. BRESNAHAN
DIRECTOR OF AVIATION

18741 NORTH AIRPORT WAY
SANTA ANA, CALIFORNIA [illegible]

TELEPHONE: [illegible]
AREA CODE 714

August 1, 1974

Mrs. Carole S. Tanner
Project Engineer
Hydrospace-Challenger, Inc.,
1160 Rosecrans Street
San Diego, California 92106

Subject: Noise Monitoring Systems

Dear Mrs. Tanner:

Attached please find the completed detailed form which provides information relative to the Noise Monitoring System functioning at Orange County Airport as requested in your letter of July 15, 1974.

I trust this data will facilitate the completion of your EPA report. If we can be of further assistance to you, please let us know.

Sincerely yours,

Norman G. Ewers
Airport Noise and
Environmental Specialist

NGE:AJG:laf
Encls.

AIRPORT LOCATION AND PHYSICAL FEATURES

LOCATION
Santa Ana, California

LATITUDE
33-40-30N

LONGITUDE
117-52-00W

ELEVATION
51.32

TERRAIN
Coastal Airport - relatively flat terrain

APPROACHES
Residential/Industrial

GENERAL LOCATION MAP

Los Angeles
Santa Ana

TOTAL JET OPS
80
Average

DAY
68

EVE
12

NIGHT
0

NIGHT RESTRICTIONS
Curfew on Jet Ops
2300 to 0700 Hours

DATE INSTALLED
October 1971

TERMINAL TRACKING
NA

THRESHOLD
112.5 Takeoff
MI 110.1 Landing

VIBRATION HISTORY

INSTALLATION MAP

SEE ATTACHED

SYNOPSIS OF SYSTEM

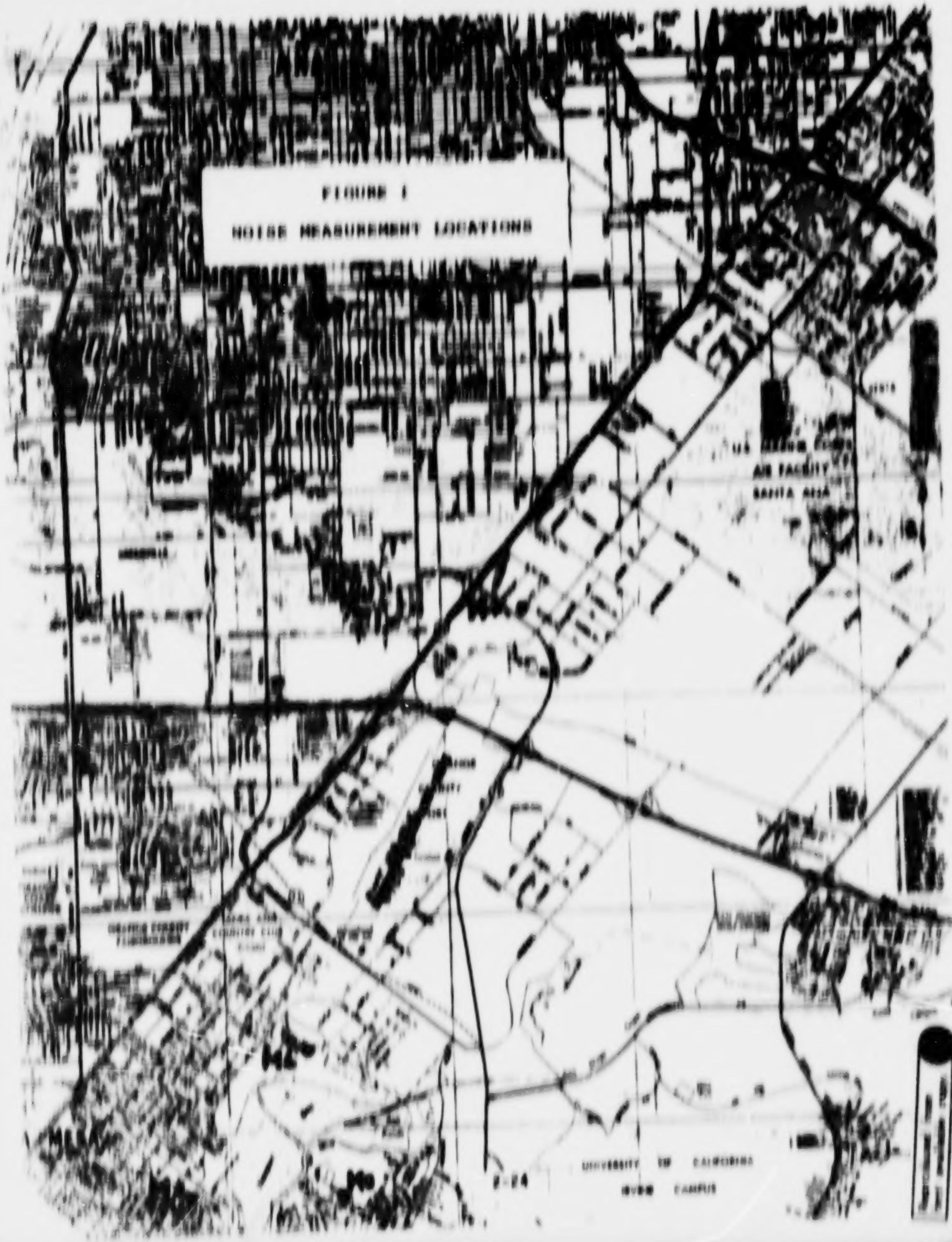
Orange County Airport Noise Monitoring System consists of 5 permanent installations to monitor airport operations in accordance with California Noise Standards. Provision for area testing is accomplished by utilization of fixed station electronics with a tape recorder in a portable console.

Flyover noise is captured by pole mounted dynamic microphones and converted by station electronics to a frequency analog of the noise power in decibels. The frequency analog signal is transmitted by telephone line to the central processor interface. At this point the frequency of the signal is measured during a random portion of a one-second time interval. The interface supplies digital words to the computer once every second. When the flyover is concluded, appropriate noise calculations are performed and printed by the teleprinter. The SENEL for each monitor station is added to an accumulator and at the beginning of each hour the logarithm of the sum is used to calculate the hourly noise level. The hourly sums are added to the CNEL accumulator where at the end of each day the 24 hour sums are used to calculate a print out of the CNEL.

NOTES

FIGURE 1

NOISE MEASUREMENT LOCATIONS


U.S. MARINE CORPS AIR FACILITY SANTA ANA
UNIVERSITY OF CALIFORNIA
IRVINE CAMPUS

AIRPORT TYPICAL WEATHER CONDITIONS

WEATHER MEASUREMENTS AT AIRPORT FAA tower 0600 - 2200 hours	TEMPERATURE 52° - 72° Average Monthly Range
	HUMIDITY
	WIND 220° at 6 knots
	RAINFALL 14"/Year

TEMPERATURE

RAIN

HUMIDITY

WIND

TOTAL SYSTEM PERFORMANCE

NOISE STANDARD, LAW, REGULATION GOVERNING SYSTEM DESIGN

California Noise Standards

UNIT OF NOISE MEASUREMENT

Time integrated dBA -- SENEL, HNL, CNEL

RANGE AND RESOLUTION OF NOISE THRESHOLD SETTING

60 - 120 dB in 1 dB increments

VIOLATION DETERMINATION

SENEL above violation threshold

VIOLATION THRESHOLD RANGE AND RESOLUTION
60-120 dB in 1 dB increments
Selectable with readout in 0.5 dB steps

VIOLATION LIMIT RANGE AND RESOLUTION
SENEL's of approximately 70 dB to 120 dB in
0.5 dB steps

ON LINE/OFF LINE DATA AVAILABILITY On line	PERCENT UTILIZATION OF SYSTEM 90% Operations 10% Maintenance & Calibration
TIME TO INSTALL OR ACTIVATE SITE 6 Months	WEATHER REQUIREMENT AT SITE All Weather Operations
DATA USAGE ☒ LITIGATION INVOLVING NOISE LEVELS ☐ PHYSICAL ACOUSTICAL RESEARCH ☒ COMMUNITY RESPONSE ☒ AIRPORT PLANNING ☐ CERTIFICATION OF AIRCRAFT	DATA REVIEWED BY: ☒ AIRPORT OPERATOR ☒ CITY, COUNTY ☒ STATE ☐ FEDERAL ☐ ACOUSTICAL CONSULTANT ☐ ENVIRONMENTAL GROUPS ☒ AIRCRAFT OPERATORS

TOTAL SYSTEM ACCURACY	SYSTEM RESOLUTION	SYSTEM RANGE
± 1.5 dB	0.5 dB	60-120 dB

SYSTEM OPTIONS EXPANDABILITY

Expandability: to 16 Stations

REMOTE SITES - ACOUSTIC SENSORS

TYPE
ALTEC 688B Microphone

NUMBER
5

INSTALLATION
Mounted on 20' (Min) Mast

INSTALLATION FREQUENCY RESPONSE
In accordance with ASA S1.4-1961 specification for type I precision sound level meters

LINEARITY
Less than 0.5 dB over dynamic range

TEMP COEFFICIENT
***

PRESSURE COEFFICIENT
***

HUMIDITY COEFFICIENT
*****

WINDSCREEN
Stainless Steel over Foam

BIRD PROTECTION
None

LIGHTNING PROTECTION
None

PREAMP GAIN
******

MIN NOISE LEVEL OF MIC/PREAMP
*****

PHOTO

NOTES

1. Operating temp: 20°-140°F
2. Humidity: 100%
3. Wind - Gusts up to 75 MPH (Wind in excess of 20 MPH degrades system accuracy)

REMOTE SITES - EQUIPMENT

SIGNAL CONDITIONING
A - Weighting Network

GAIN RANGES
Single Range 60-120 dB

GAIN SELECTION NA

DETECTION
A-Weighting using analog to digital conversion

RMS LOG CONVERSION
Digital Computation

MODEL

SAMPLE RATE 11 seconds	**MESSAGE CONTENT** 600-1200 by frequency analog of noise levels in dB

ACOUSTIC CALIBRATION GR1562 sound level calibrator directly coupled to microphone

INSERT CALIBRATION
2KHz, 1KHz, 500 Hz, 250 Hz, 125 Hz

ACTUAL MONITORING Raw signal converted to frequency analog and transmitted over telephone line

REMOTE CONTROLLABLE FUNCTIONS
None

SIZE 16 X 12 X 6	**WEIGHT** 55#	**TEMP RANGE** -20° to +140°F
CONSTRUCTION Steel/Aluminum	**POWER REQUIREMENTS** 120V AC 10 Watts Max	**TIME OF UNATTENDED OPERATION** Unlimited

COMMUNICATION
Communicator using station telephone lines

PHOTO	**NOTES**

TRANSMISSION LINK

TYPE
KD Schedule 4, Class C-1 conditioned telephone line

CHANNELS PER SITE
One (1)

PATH LENGTHS
2-6 miles

TRANSMISSION POWER LEVEL

FREQUENCY RESPONSE OF CHANNEL
300-3000 Hz

DYNAMIC RANGE

MODEM
Pulse duration modulation

MESSAGE RATE 120 frames/second	BIT RATE

MESSAGE CONTENT

ERROR DETECTION

ERROR CORRECTION

MESSAGE FORMAT

CENTRAL DATA PROCESSING AND DISPLAY

TYPE OF PROCESSOR 8 bit general purpose digital computer
Data General Nova 1200

SUBSYSTEMS AND EQUIPMENT CONFIGURATION

1. teleprinter

DISPLAYS, ALARMS, MONITORS

1. 5 channel lighted display
2. teleprinter alarm for noisy events

NO. REMOTE SITES
5

PROVISION FOR NEW SITES
2

SIZE
5' x 2' x 2'

WEIGHT

POWER

TEMP RANGE
+32° to 120°F

TIME OF UNATTENDED OPERATION
700 hours for teleprinter paper

LOGS

1. SEMEL for each station
2. HNL " " "
3. CHEL " " "

PHOTO

NOTES

CENTRAL PROCESSING SOFTWARE

NUMBER WORDS OF PROGRAM	NUMBER WORDS OF DATA
NUMBER WORDS SPARE	PEAK PERCENTAGE UTILIZATION OF COMPUTER
METHOD OF LOADING PROGRAM Standard 8 channel Punched Tape	PROVISIONS FOR ERROR MESSAGES
NUMBER OF OPERATOR INPUTS 18 Operational Command	

TRACKING

TYPE NONE USED		
RANGE COVERAGE	RANGE ACCURACY	RANGE RATE
BEARING COVERAGE	BEARING ACCURACY	BEARING RATE
ALTITUDE COVERAGE	ALTITUDE ACCURACY	ALTITUDE RATE
NUMBER TRACKING SITES	LOCATION	
ACTIVE/PASSIVE TARGETS	TRANSPONDER OR BEACON	
ANALOG/DIGITAL RECORDING OF DATA	REAL TIME PLOT OF TARGET	PLOT SCALE
RECORDED DATA ACCURACY	OFF LINE PROCESSING TURNAROUND TIME	PLOT ACCURACY
PROCESSED PLOT OF TARGET	PROCESSED PLOT SCALE	PROCESSED ACCURACY
LINE PRINTER PARAMETERS LISTED		
RATE PARAMETERS ARE LISTED ON LINE PRINTER		
PHOTO	NOTES	

SYSTEM COST/SCHEDULE

DESIGN COST ***	DESIGN MAN MONTHS ***	DESIGN PERIOD ***
PROCUREMENT COST $58,000	PROCUREMENT MAN MONTHS ***	PROCUREMENT PERIOD ***
SYSTEM COST INSTALLED $58,000	MANUFACTURE MAN MONTHS ***	MANUFACTURE PERIOD ***

YEARLY MAINTENANCE COST	RENTAL LEASE COST PER YEAR ***
OPERATIONS COST	LIFE EXPECTANCY Ammortization rate 5 years
CURRENT REPLACEMENT COST Unknown	

PERSONNEL REQUIREMENTS (NUMBER PEOPLE AND MAN HOURS PER YEAR)

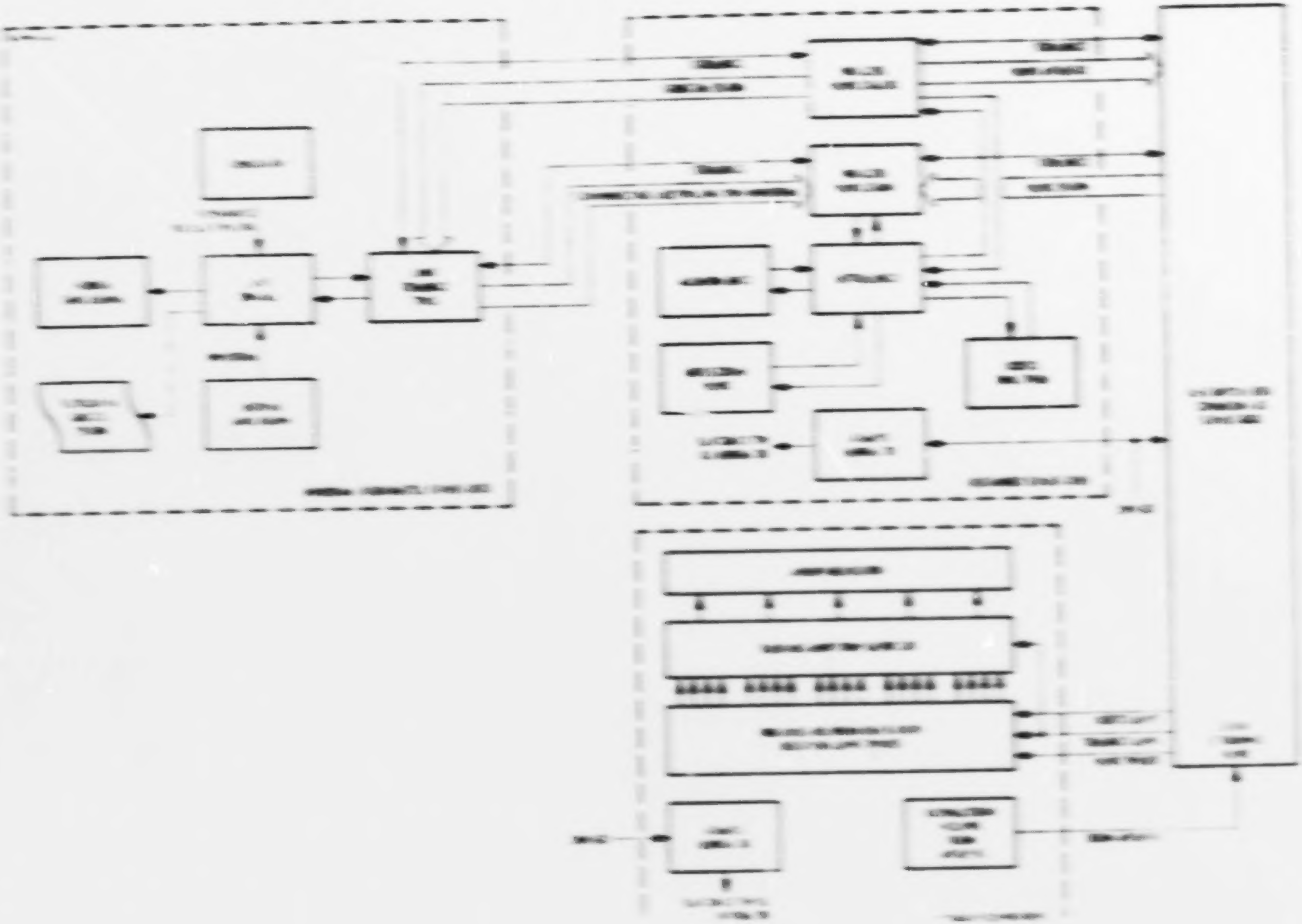
MAINTENANCE 1 MAN HOURS 200

OPERATION 1 MAN HOURS 50

DATA REVIEW 1 MAN HOURS 1200

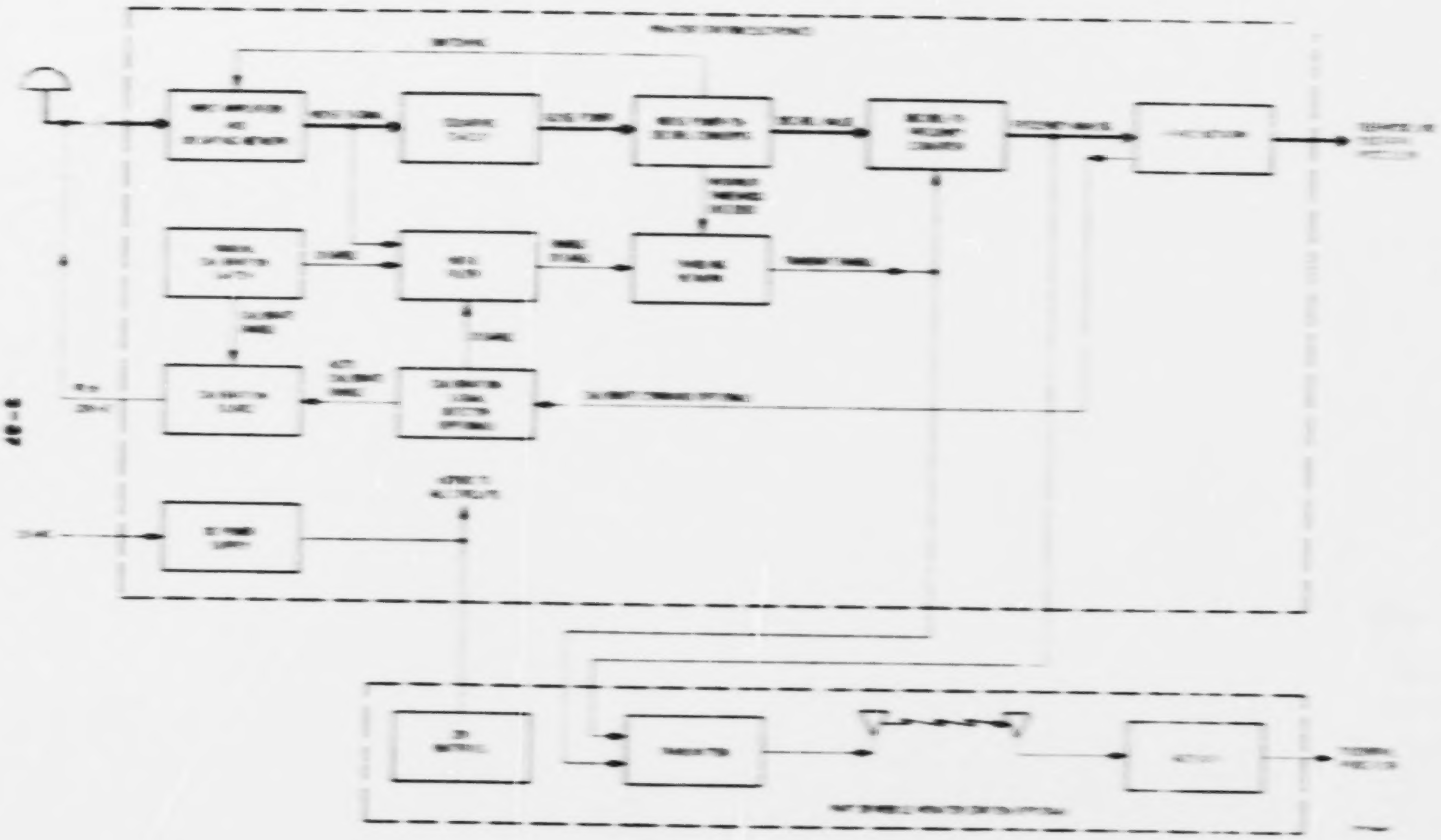
CENTRAL PROCESSING UNIT BLOCK DIAGRAM

SEE ATTACHED



REMOTE SITE BLOCK DIAGRAM

SEE ATTACHED



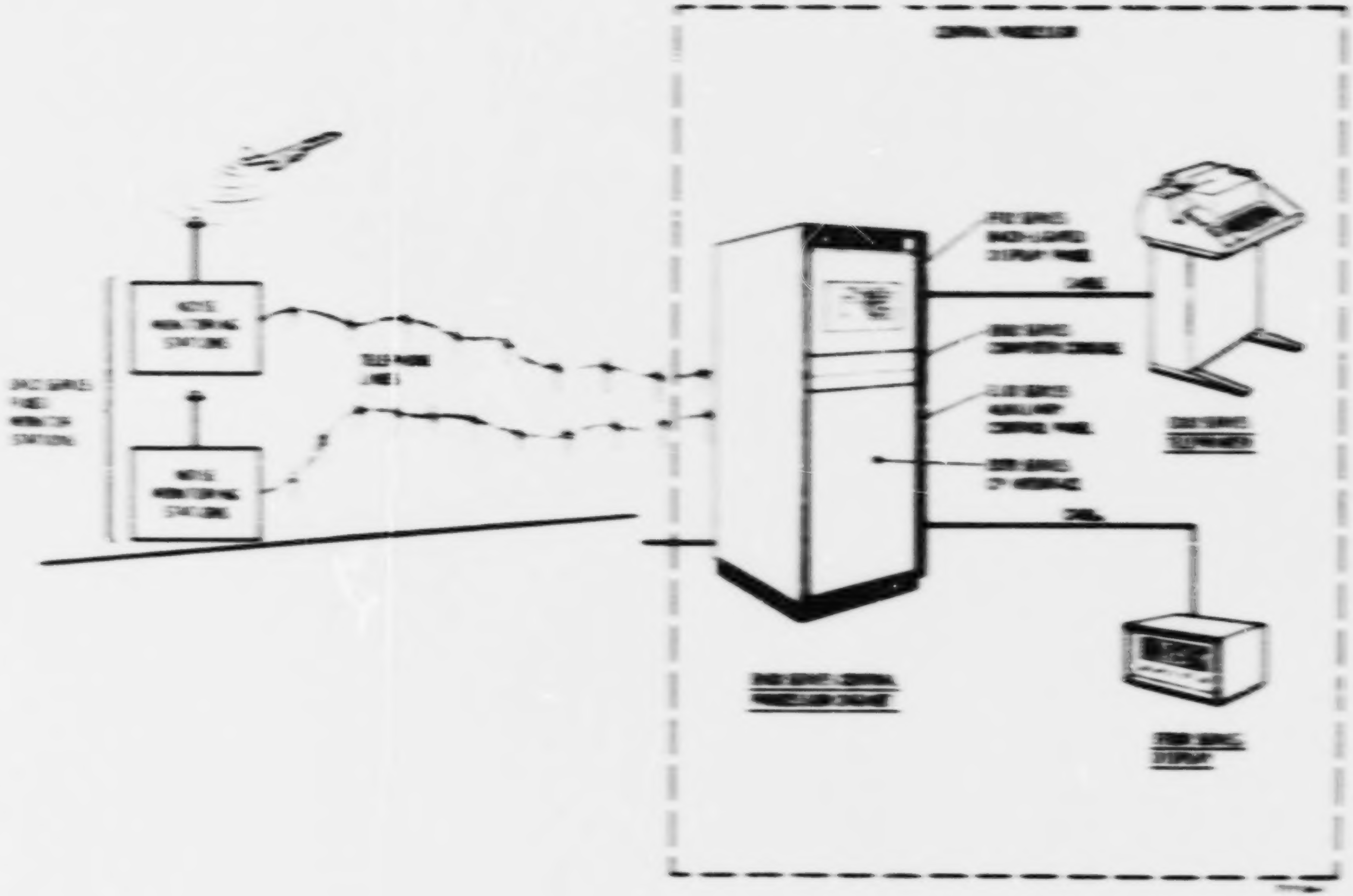

NOISE MONITORING STATION
NOISE MONITORING STATION
TELEPHONE LINES

Figure 2-1. [illegible]

No. 71Y105

ECOLOG. I

DESCRIPTION, OPERATION and SPECIFICATIONS

May 1971

Northrop Corporation, Electro-Mechanical Division
500 East Orangethorpe Avenue, Anaheim, California 92801
NORTHROP

DESCRIPTION

INTRODUCTION

The ECOLOG I is designed specifically to monitor and record the noise generated by aircraft in and near airports. To provide for anticipated airport growth, the system is designed as a highly flexible noise monitoring system that can adapt itself to a wide range of varying requirements with minimum additional cost to the operator or the community. Provisions are made for the modular addition of monitoring stations; increased data processing capability, magnetic tape recorders, special displays, plotters, etc; and changes in processing requirements or output data. Thus, changes in airport operations, types of aircraft, community distribution, or new laws enacted by the government can be easily accommodated.

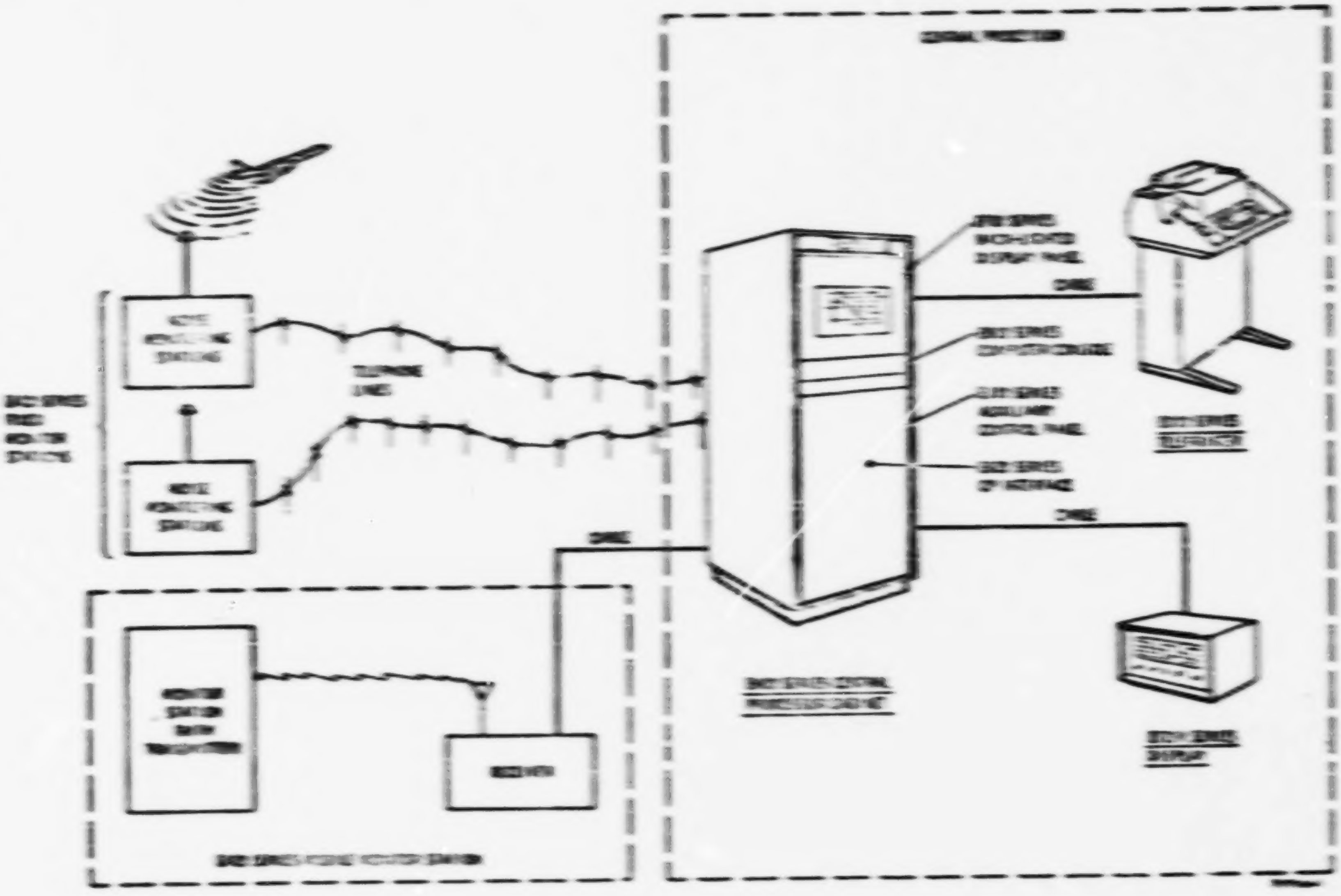
ECOLOG I can be programmed to output data in any of the commonly used single event noise indexes and accumulative noise exposure indexes. Examples of single event indexes are dB(A), dB(D), PNdB, EPNdB, and SENEL. Daily noise exposure indexes commonly in use include NEF, CNR, Leq, and CNEL. The system is adaptable by software change to any location in the world.

The system can accommodate up to 16 noise monitoring stations simply by the installation of more monitoring stations. Beyond this, additional chassis and monitoring stations can be added as desired. Although airports may never need this extensive degree of coverage, it is possible to assign portable stations to monitor selected urban and industrial noise sources about which complaints are received.

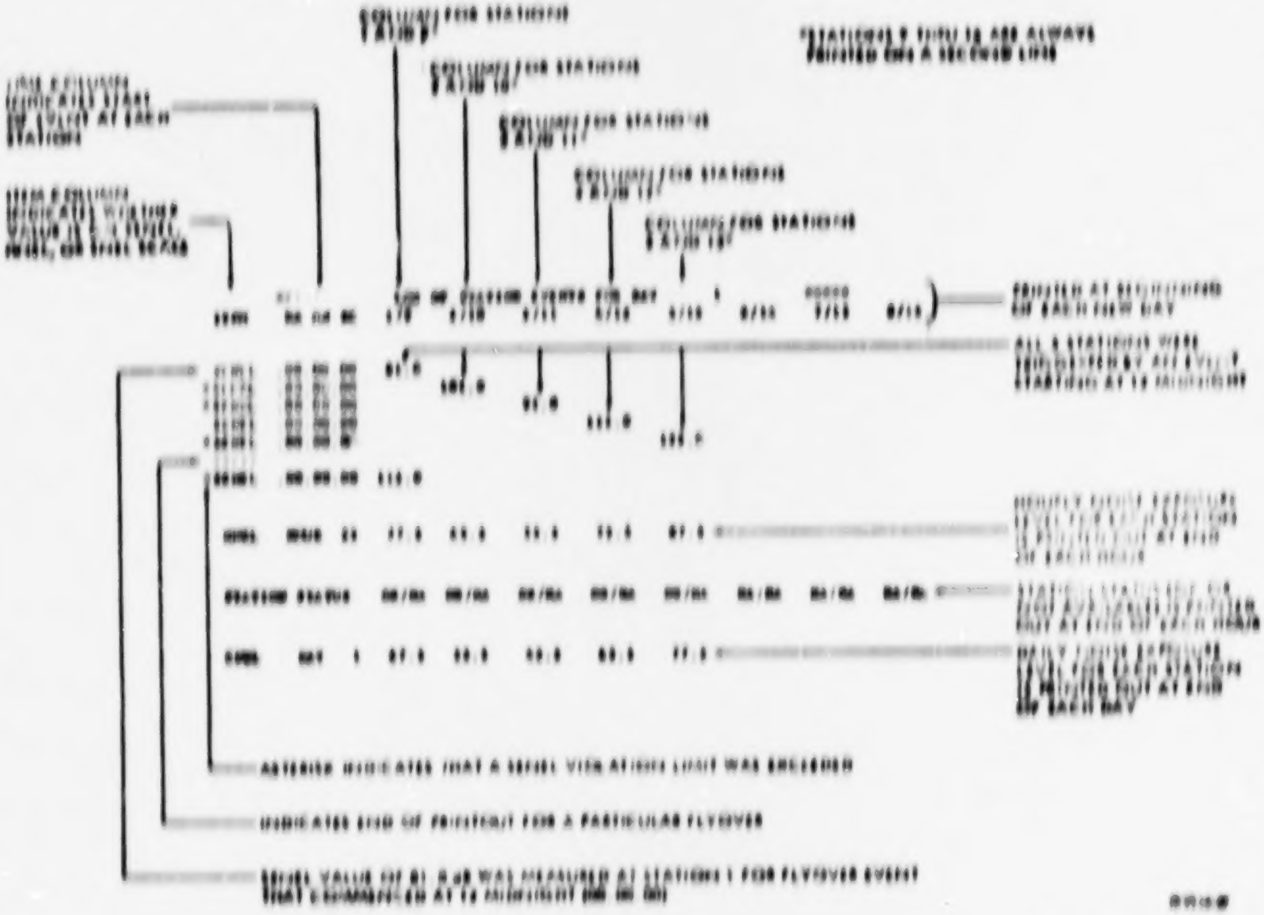
The system is equipped with unique features which eliminate other unwanted noise due to ambient sources such as street traffic, construction, etc. Also, the tedious and difficult requirement for manual editing of data to eliminate undesired noise components is eliminated.

The system provides a permanent record of all noise levels recorded. It gives the airport manager immediate real-time notice of a single event violation by means of a visual display panel and an audible alarm, both of which are located in his office. It also provides him with the data on an hourly noise exposure index and daily noise exposure index.

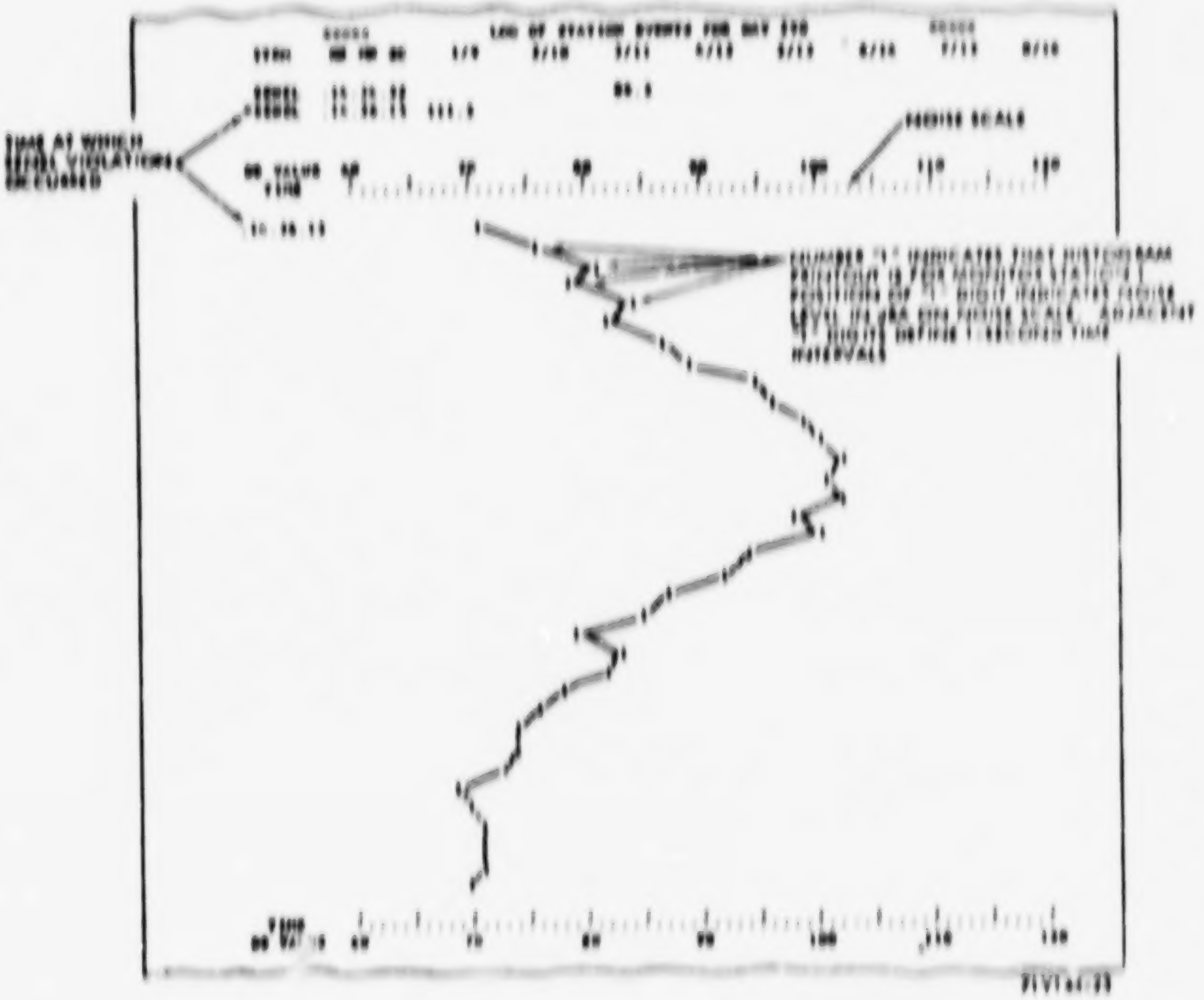
In the paragraphs that follow, the technical details of a complete noise monitoring system and associated hardware are described and discussed in detail. A typical installation is used to illustrate the total system. A user should keep in mind that the various system components can be integrated in several ways to achieve custom installation.


CENTRAL PROCESSOR
NOISE MONITORING STATIONS
NOISE MONITORING STATIONS
TELEPHONE LINES
CABLE
CABLE
CABLE
TELEPRINTER
DISPLAY
MONITOR STATION DATA TRANSMITTER
RECEIVER

TYPICAL [illegible] I SYSTEM


STATIONS 6 THRU 10 ARE ALWAYS PRINTED ON A SECOND LINE
COLUMNS FOR STATIONS
LOG OF STATION EVENTS FOR DAY
PRINTED AT BEGINNING OF EACH NEW DAY
STATION STATUS
ASTERISK INDICATES THAT A SENEL VIOLATION LIMIT WAS EXCEEDED
INDICATES END OF PRINTOUT FOR A PARTICULAR FLYOVER

STATION EVENTS LOG PRINTOUT FORMAT



HISTOGRAM PRINTOUT FORMAT

2.3 SAN JOSE AIRPORT

CITY OF SAN JOSE
CALIFORNIA

TELEPHONE 277-4000, EXT. [illegible]
1661 AIRPORT BLVD.
SAN JOSE, CALIFORNIA 95110

AIRPORT DEPARTMENT

July 30, 1974

Mrs. Carole S. Tanner
Project Engineer
Hydrospace-Challenger, Inc.
1360 Rosecrans Street
San Diego, Ca. 92106

Dear Carole:

Mr. Gordon Habel of our staff has filled out the forms for the EPA Report with as much of the data as he has available to him. A copy has been submitted to Tracor, Inc., so that a complete report can be made and hopefully erroneous data can be avoided. We will ask them to call us with the information as soon as possible so that we can forward it to you.

If you have any questions, please call Gordon at (408) 277-4000, ext. 4721.

Very truly yours,

Verne B. Troup

Verne B. Troup, Deputy Assistant
Airport Planning and Development

VBT:ea
Encl.

AIRPORT LOCATION AND PHYSICAL FEATURES

LOCATION San Jose, California, USA	LATITUDE 37°21'48"	LONGITUDE 121°55'40"

ELEVATION 63.05 feet	TERRAIN Relatively level with 2000 to 4000 foot mountains 10 to 20 miles to the east and west.

APPROACHES
A mixture of residential, industrial, and farming.

GENERAL LOCATION MAP

San Francisco
San Jose
Los Angeles
San Diego

TOTAL JET OPS
130/day

DAY
83 [illegible]

EVE
43 [illegible]

NIGHT
4

FLIGHT RESTRICTIONS
See Note ①

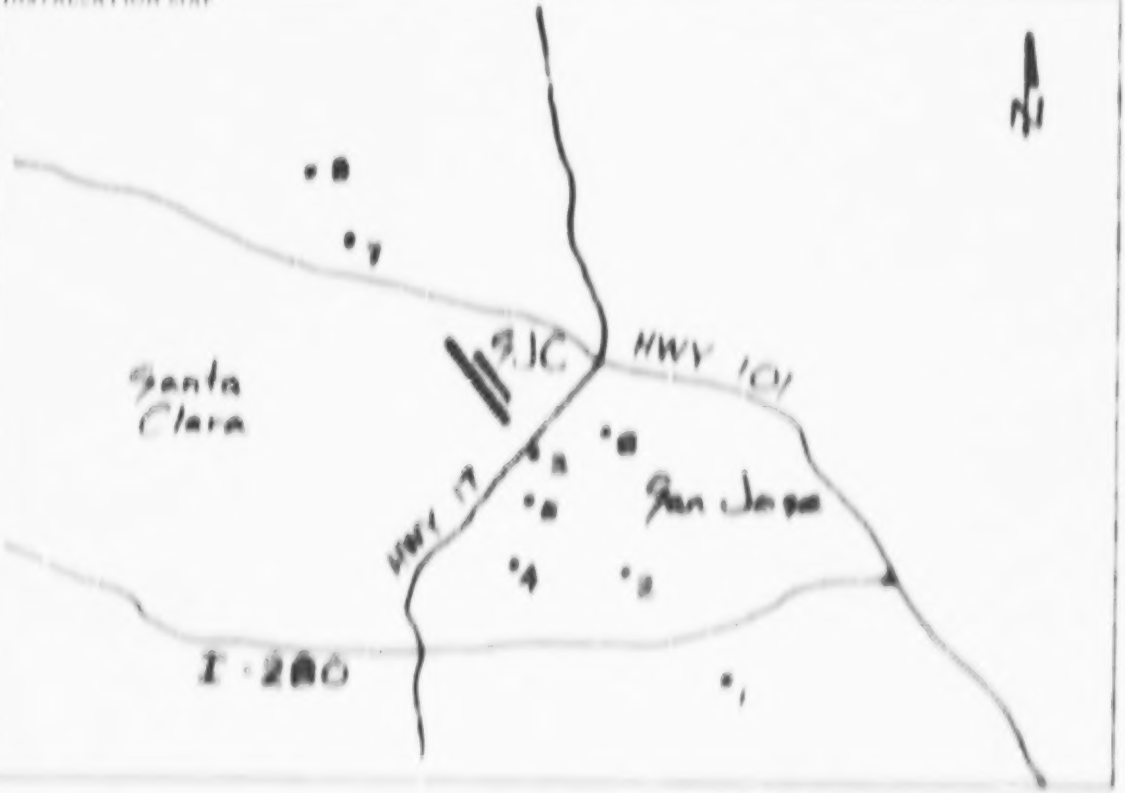
DATE INSTALLED
November '73

TERMINAL TRACKING
119 Runway 30 L

[illegible]
Site 3 - [illegible] [illegible]
Site 4 - [illegible] [illegible]

VIOLATION HISTORY
None to date.

INSTALLATION MAP


N
8
7
SJC
HWY 101
Santa Clara
6
5
3
San Jose
HWY 17
4
2
I-280
1

SYNOPSIS OF SYSTEM

Eight monitor locations continuously per California Noise Std's (NEL, CNEL, SENEL, dBA). Remote sites are pole-mounted Chesapeake microphones and digital computation of dBA [illegible]/sec. Transmission is FSK (1070-1270 Hz) of dB value. Single range covers 55-130 dBA. Calibration is by hand-held pistonphone and electrical insert commanded from either the site or the airport. Raw acoustic signal compressed and sent on second telephone line for aural monitoring at airport. Central monitor is a 16K minicomputer which logs hourly, daily, and violation levels. Tower conversations are continuously monitored and a log is kept for about one month. Software screening used to eliminate non-aircraft noise. Acoustic tracking used to sense traffic pattern direction and set violation limits.

NOTES

① Jet traffic between 2400 and 0600 hours is encouraged to use runway approachs and departures to and from the north to avoid downtown and heavy residential areas to the south.

AIRPORT TYPICAL WEATHER CONDITIONS

WEATHER MEASUREMENTS AT AIRPORT

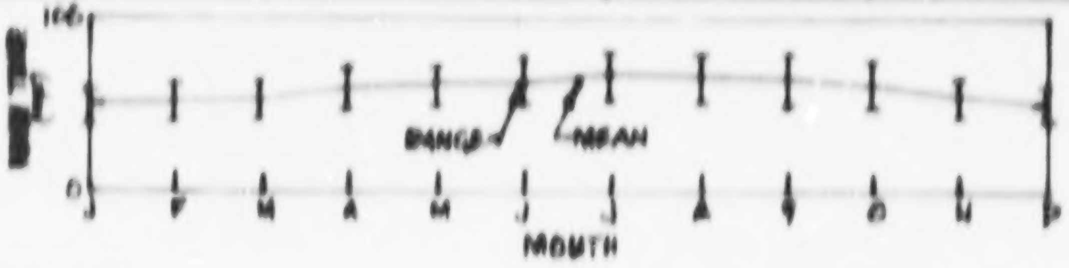
U.S. Department of Commerce, Weather-Bureau

TEMPERATURE 59.4°F yearly mean

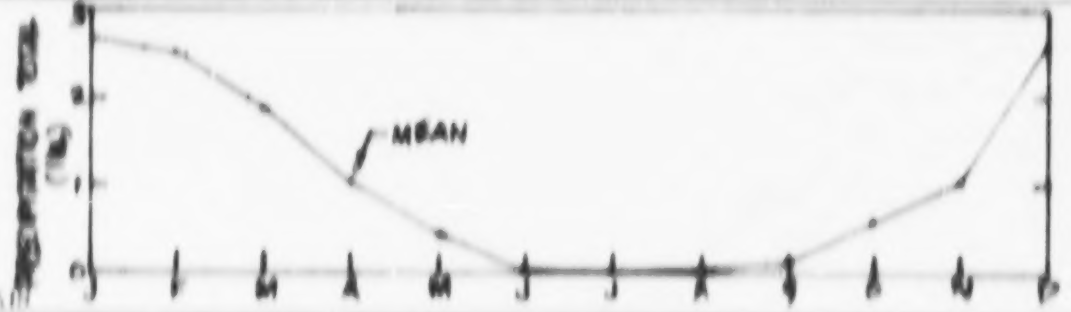
HUMIDITY 55.9% yearly mean

WIND 5.1 Knots yearly mean

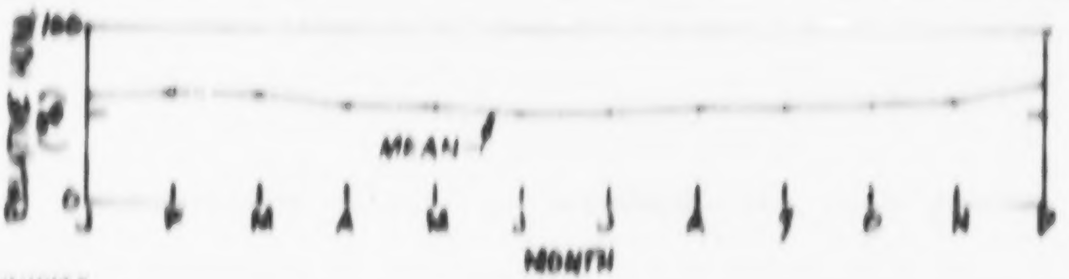
RAINFALL 13.1 inches yearly mean



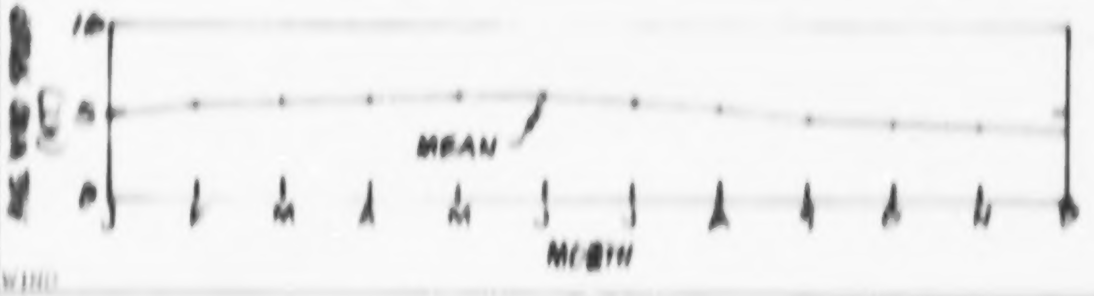
TEMPERATURE



RAIN



HUMIDITY



WIND

TOTAL SYSTEM PERFORMANCE

NOISE STANDARD, LAW, REGULATION GOVERNING SYSTEM DESIGN
California Noise Standards

UNIT OF NOISE MEASUREMENT
Time integrated dBA above a threshold - CNEL, HNL, SENEL

RANGE AND RESOLUTION OF NOISE THRESHOLD SETTING
55 to 70 dBA, in 1-dB steps

VIOLATION DETERMINATION
Integrated dBA above a violation threshold of single event - SENEL

VIOLATION THRESHOLD RANGE AND RESOLUTION
Noise levels of 60 to 90 dBA, in 1-dBA steps

VIOLATION LIMIT RANGE AND RESOLUTION
Noise exposure levels 85 to 125 dBA, in 1-dBA steps

ON LINE OFF LINE DATA AVAILABILITY On line	PERCENT UTILIZATION OF SYSTEM Continuous
TIME TO INSTALL OR ACTIVATE SITE Not applicable	WEATHER REQUIREMENT AT SITE All weather operation

DATA USAGE

- ☑ LITIGATION INVOLVING NOISE LEVELS
- ☐ PHYSICAL ACOUSTICAL RESEARCH
- ☑ COMMUNITY RESPONSE
- ☑ AIRPORT PLANNING
- ☐ CERTIFICATION OF AIRCRAFT

DATA REVIEWED BY:

- ☑ AIRPORT OPERATOR
- ☑ CITY, COUNTY
- ☑ STATE
- ☐ FEDERAL
- ☐ ACOUSTICAL CONSULTANT
- ☐ ENVIRONMENTAL GROUPS
- ☐ AIRCRAFT OPERATORS

TOTAL SYSTEM ACCURACY ± 1.5 dBA	SYSTEM RESOLUTION 1 dBA	SYSTEM RANGE 55-130 dBA

SYSTEM OPTIONS EXPANDABILITY
Provision included for later expansion to 15 sites.

REMOTE SITES - ACOUSTIC SENSORS

TYPE Chesapeake NM 137A	NUMBER 8

INSTALLATION
Pole-mounted and wall-mounted, 20 ft min and 10 ft above obstruction

INSTALLATION FREQUENCY RESPONSE

LINEARITY ± 0.2 dB		TEMP COEFFICIENT ± 0.5dB from 30°F to 120°F	PRESSURE COEFFICIENT –
HUMIDITY COEFFICIENT < 0.5 dB gain	WINDSCREEN Stainless steel screen cylinder	BIRD PROTECTION None	LIGHTNING PROTECTION None

PREAMP GAIN

MIN NOISE LEVEL OF MIC/PREAMP
40 dBA

PHOTO

NOTES

REMOTE SITES – EQUIPMENT

SIGNAL CONDITIONING
A-weighting network

GAIN RANGES
Single range 55-130 dBA

GAIN SELECTION

DETECTION

RMS – LOG CONVERSION
Digital computation

MODEM
Frequency shift Keying 1070-1270 Hz.

SAMPLE RATE
2/sec.

MESSAGE CONTENT

ACOUSTIC CALIBRATION
Hand held pistonphone placed on microphone

INSERT CALIBRATION
1 KHz inserted at mic equal to 110dBA – on command from central or site

ACTUAL MONITORING

REMOTE CONTROLLABLE FUNCTIONS
Insert calibration activated by FSK ①

SIZE
22"×34"×15"

WEIGHT

TEMP RANGE

CONSTRUCTION
Replaceable PC cards

POWER REQUIREMENTS

TIME OF UNATTENDED OPERATION
Unlimited

COMMUNICATION
Telephone handset use separate communication line

PHOTO

NOTES

① A continuous 2025 Hz signal is sent to RRIS and a 2225 Hz signal is sent when put in calibration.

TRANSMISSION LINK

TYPE
Voice grade telephone line

CHANNELS PER SITE

PATH LENGTHS

TRANSMISSION POWER LEVEL

FREQUENCY RESPONSE OF CHANNEL

DYNAMIC RANGE

MODEM
Frequency-shift Keying

MESSAGE RATE 2 / second	BIT RATE 110 / second

MESSAGE CONTENT
(11 bits/character) 5 characters

ERROR DETECTION

ERROR CORRECTION

MESSAGE FORMAT

CENTRAL DATA PROCESSING AND DISPLAY

TYPE OF PROCESSOR

16 bit general purpose digital computer, Data General - Nova 1220

SUBSYSTEMS AND EQUIPMENT CONFIGURATION

1. 16,384-word core memory
2. Power fail/restart

DISPLAYS, ALARMS, MONITORS

1. Panel meters for continuous HNL at site.
2. Alarm for violations
3. Audio monitor of selected site
4. Teleprinter messages and alarms to operator ①
5. Site activity indicator map.
6. Date and time display.

NO. REMOTE SITES 8

PROVISION FOR NEW SITES 7

SIZE

WEIGHT

POWER

TEMP RANGE

TIME OF UNATTENDED OPERATION

LOGS

1. Hourly log of HNL for sites
2. Daily log of CNEL for sites
3. Daily calibration of sites.
4. Violation levels, violation histogram and time for violation.
5. Daily summary of violations

PHOTO

NOTES

① Teleprinter messages:
- SENEL violation
- Interruption of power
- Change in duty runway
- Post violation calibration
- SENEL levels and histogram for non-violation aircraft

CENTRAL PROCESSING SOFTWARE

NUMBER WORDS OF PROGRAM	NUMBER WORDS OF DATA
NUMBER WORDS SPARE	PEAK PERCENTAGE UTILIZATION OF COMPUTER
METHOD OF LOADING PROGRAM Digital paper tape	PROVISIONS FOR ERROR MESSAGES
NUMBER OF OPERATOR INPUTS 20 optional commands	

TRACKING

TYPE None used at San Jose Municipal Airport ①		
RANGE COVERAGE	RANGE ACCURACY	RANGE RATE
BEARING COVERAGE	BEARING ACCURACY	BEARING RATE
ALTITUDE COVERAGE	ALTITUDE ACCURACY	ALTITUDE RATE
NUMBER TRACKING SITES	LOCATION	
ACTIVE/PASSIVE TARGETS	TRANSPONDER OR BEACON	
ANALOG/DIGITAL RECORDING OF DATA	REAL TIME PLOT OF TARGET	PLOT SCALE
RECORDED DATA ACCURACY	OFF LINE PROCESSING TURNAROUND TIME	PLOT ACCURACY
PROCESSED PLOT OF TARGET	PROCESSED PLOT SCALE	PROCESSED ACCURACY
LINE PRINTER PARAMETERS LISTED		
RATE PARAMETERS ARE LISTED ON LINE PRINTER		
PHOTO	NOTES ① Sequence in which acoustic level exceeds thresholds at sites is used to determine runway direction in use.	

SYSTEM COST/SCHEDULE

DESIGN COST	DESIGN MAN-MONTHS	DESIGN PERIOD
PROCUREMENT COST	PROCUREMENT MAN-MONTHS	PROCUREMENT PERIOD
SYSTEM COST INSTALLED $130,000	MANUFACTURE MAN-MONTHS	MANUFACTURE PERIOD

YEARLY MAINTENANCE COST $5,000	RENTAL/LEASE COST PER YEAR
OPERATIONS COST	LIFE EXPECTANCY
CURRENT REPLACEMENT COST	

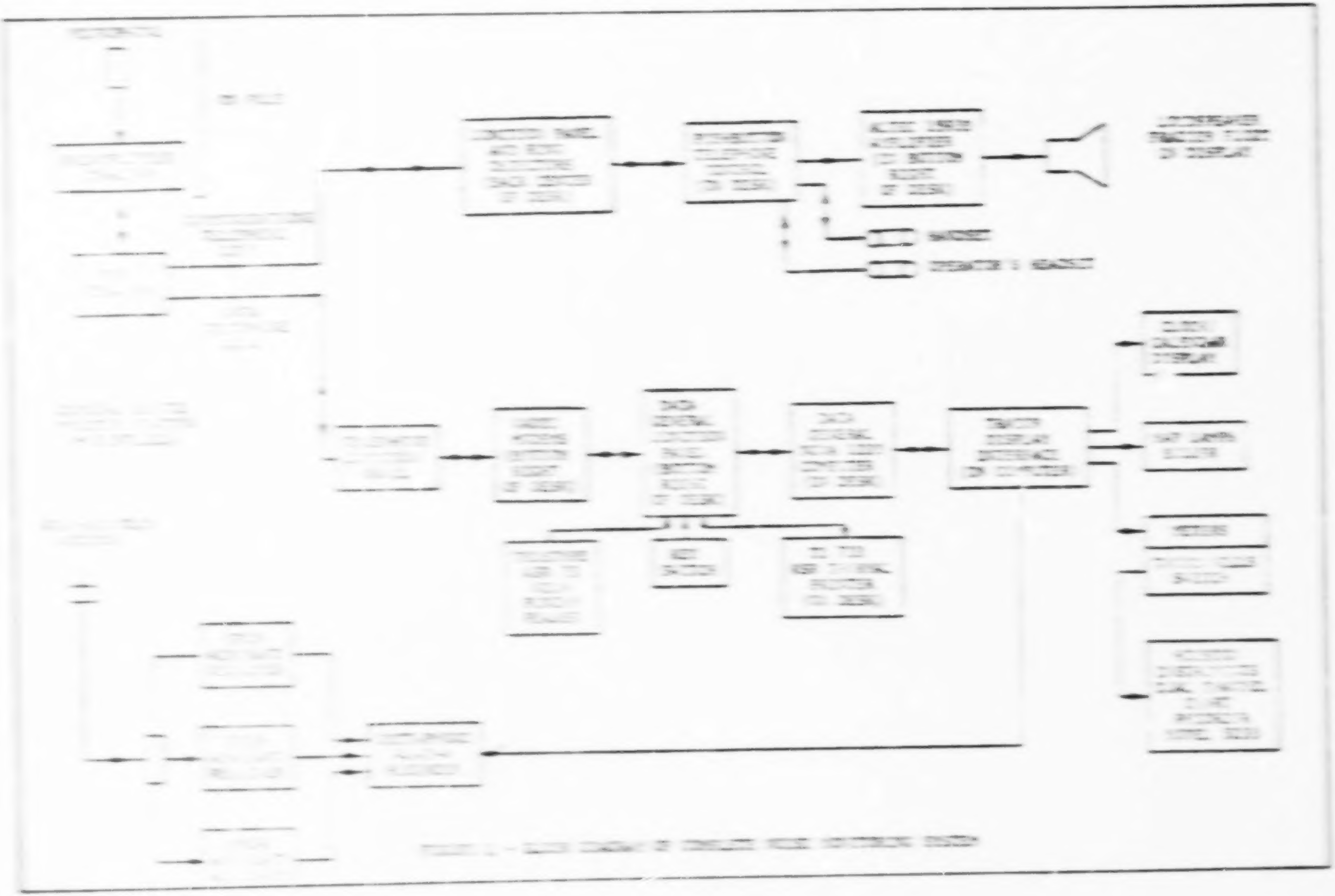
PERSONNEL REQUIREMENTS IN NUMBER PEOPLE AND MAN-HOURS PER YEAR

MAINTENANCE 1 MAN-HOURS 600

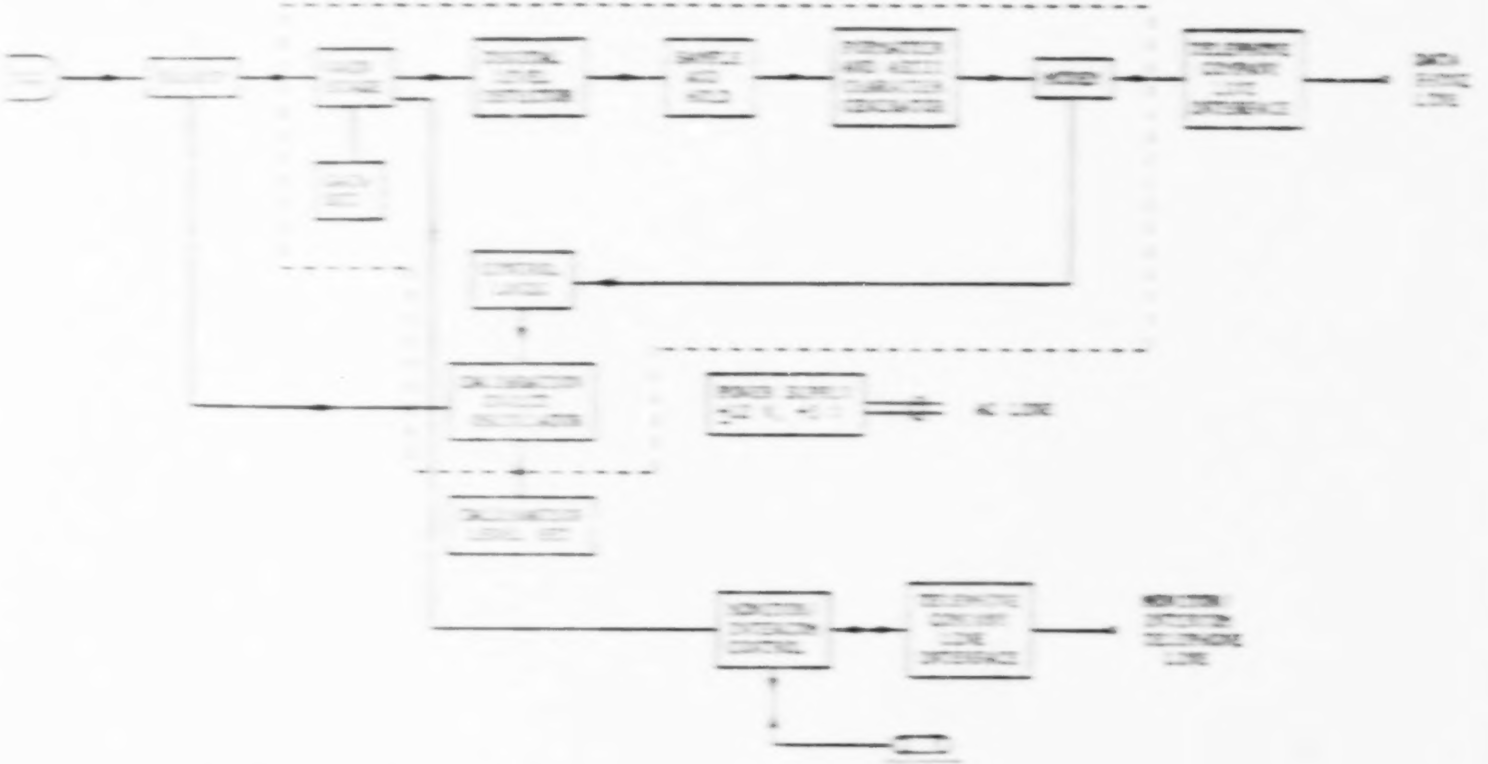
OPERATION 1 MAN-HOURS 100

DATA REVIEW 1 MAN-HOURS 100

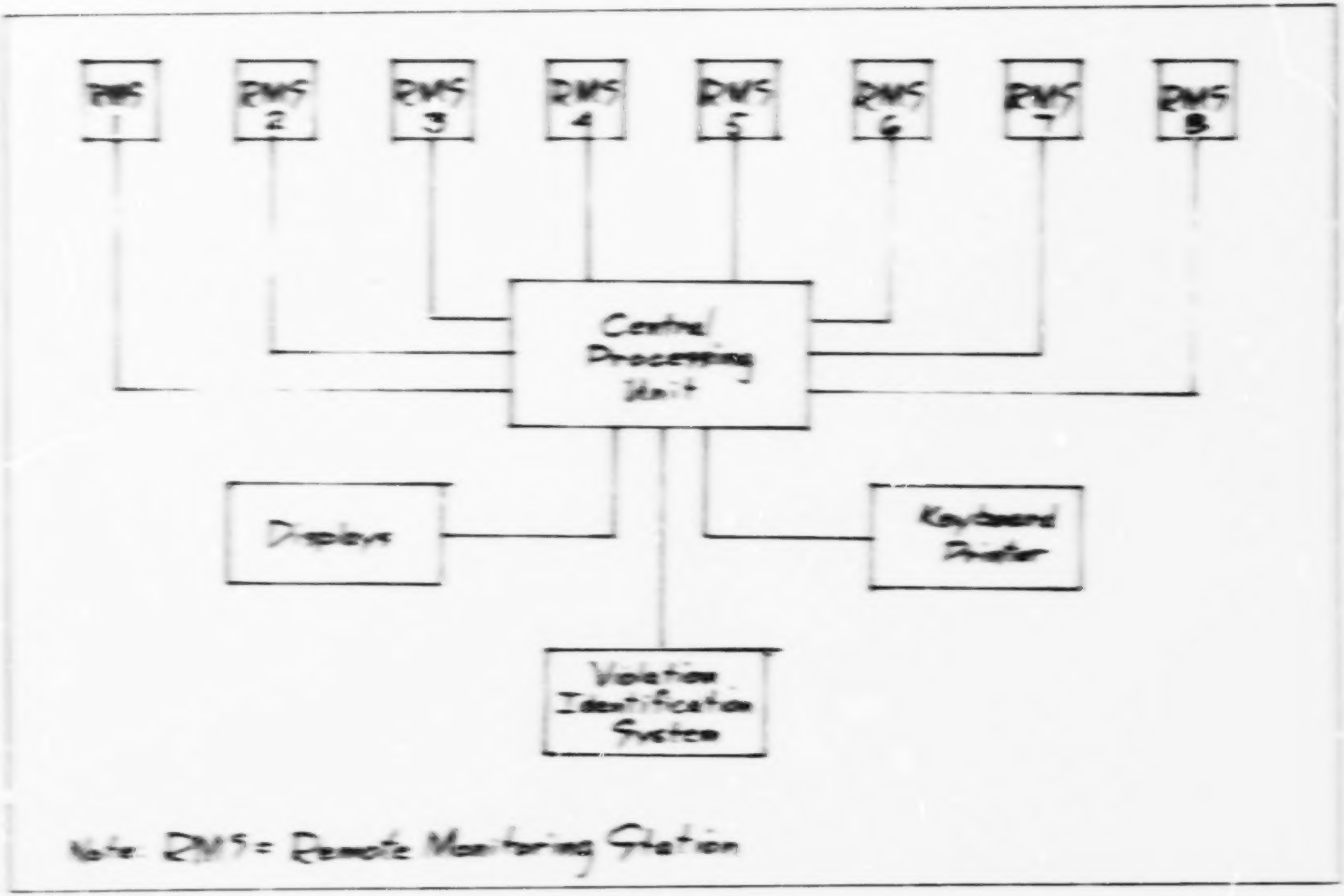
CENTRAL PROCESSING UNIT BLOCK DIAGRAM


HANDSET
OPERATOR'S HEADSET

REMOTE SITE BLOCK DIAGRAM


SAMPLE AND HOLD
MODEM
TELEPHONE COMPANY LINE INTERFACE
CONTROL LOGIC
CALIBRATION LEVEL SET
POWER SUPPLY
AC LINE
TELEPHONE COMPANY LINE INTERFACE

OVERALL SYSTEM BLOCK DIAGRAM


RMS 1
RMS 2
RMS 3
RMS 4
RMS 5
RMS 6
RMS 7
RMS 8
Central Processing Unit
Displays
Keyboard Printer
Violation Identification System

Note: RMS = Remote Monitoring Station

2.4 MUNICH AIRPORT

flughafen
münchen gmbh

252

Hydrospace-Challenger, Inc.
1360 Rosecrans St.
San Diego, Calif. 92106 USA

25/7/1979

Please find enclosed the questionnaire with data of our noise monitoring system.
Entries left blank are either not applicable or could not be furnished due to shortage of time.

Yours faithfully
FLUGHAFEN MÜNCHEN GMBH
Environmental Protection Department

AIRPORT LOCATION AND PHYSICAL FEATURES

LOCATION
Munich - Riem, Germany

LATITUDE
48°07'54"N

LONGITUDE
11°41'51"E

ELEVATION
1737 feet

TERRAIN
Continental airport in flat terrain

APPROACHES
Populated residential area

GENERAL LOCATION MAP

Nürnberg
München

TOTAL JET OPS
[illegible]
[illegible] '76

DATE INSTALLED
Oct 1971

TRACKING
Yes [illegible]

DAY
> 95%

FINISHED

[illegible]

EVE

NIGHT
< 5%

VIOLATION HISTORY
Monthly reports
to [illegible]
[illegible] level

NIGHT
RESTRICTIONS
Partial
curfew [illegible]

INSTALLATION MAP

See encl 1

SYNOPSIS OF SYSTEM

Monitors 8 locations continuously.
NL are converted into frequency signals which are transmitted by telephone lines to the central station.
A range of 50 dB(A) is monitored for each site with reference (excess) levels between 81 and 100 dB(A), depending on distance from airport.
Small computer then samples from the sites at a rate of 1 per second. If threshold NL is exceeded, each event is printed on log by teletype (time, NL, duration and if applicable excess).
At midnight record of hourly and daily conditions equivalent [illegible] is printed.
In the morning a printout of the calibration of the sites is given automatically.
Noise events of less than 5 sec duration are not recorded.

NOTES

AIRPORT TYPICAL WEATHER CONDITIONS

WEATHER MEASUREMENTS AT AIRPORT Aeronautical Meteorological Service	TEMPERATURE 7.6 °C yearly mean HUMIDITY 65% at 14.00 hrs yearly mean WIND 3.5 m/s yearly mean RAINFALL 964 l/m² yearly mean

Monatliche meteorologische Mittelwerte für den Zeitraum [illegible]
Monthly meteorological mean values for the period [illegible]

Mittlerer täglicher Maximum und Minimum der Temperatur (°C)
Mean daily maximum and minimum of temperature (°C)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Maximum (a)	1.1	[illegible]	8.2	12.6	17.3	20.1	[illegible]	22.0	18.6	13.1	[illegible]	[illegible]
Minimum (b)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TEMPERATURE

RAIN

[illegible]

(a)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
(b)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

HUMIDITY

WIND

TOTAL SYSTEM PERFORMANCE

NOISE STANDARD, LAW, REGULATION GOVERNING SYSTEM DESIGN

German Law on Aircraft Noise

UNIT OF NOISE MEASUREMENT

Time integrated above a threshold, dB(A)

RANGE AND RESOLUTION OF NOISE THRESHOLD SETTING

70 - 80 dB(A) in 1 dB(A) steps

VIOLATION DETERMINATION

dB(A) above a reference NL of a single event

VIOLATION THRESHOLD RANGE AND RESOLUTION

81 - 100 dB(A) in 1 dB(A) steps

VIOLATION LIMIT RANGE AND RESOLUTION

See above

ONLINE/OFFLINE DATA AVAILABILITY

On line

PERIOD OF UTILIZATION OF SYSTEM

Continuous

TIME TO INSTALL OR ACTIVATE SITE

Not applicable

WEATHER REQUIREMENT AT SITE

All - weather, no violations recorded for wind above 15 knots

DATA USAGE

☒ LITIGATION INVOLVING NOISE LEVELS
☐ PHYSICAL ACOUSTICAL RESEARCH
☐ COMMUNITY RESPONSE
☐ AIRPORT PLANNING
☐ CERTIFICATION OF AIRCRAFT

DATA USED BY

☒ AIRPORT OPERATOR
☒ CITY/COUNTY
☒ STATE
☐ FEDERAL
☐ ACOUSTICAL CONSULTANT
☐ ENVIRONMENTAL GROUPS
☐ AIRCRAFT OPERATORS

TOTAL SYSTEM ACCURACY	SYSTEM RESOLUTION	SYSTEM RANGE
± 1 dB(A)	1 dB(A)	20 - 140 dB(A)

SYSTEM OPTIONS/EXPANDABILITY

Provisions included for later expansion to 12 sites.

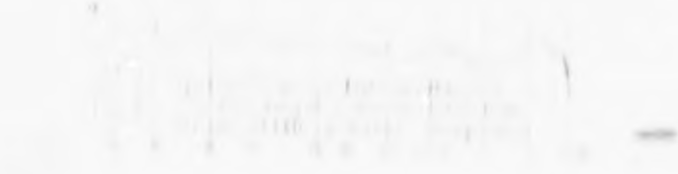
REMOTE SITES – ACOUSTIC SENSORS

TYPE Rohde + Schwarz MKPM	[illegible] 8

INSTALLATION

[illegible]

[illegible]

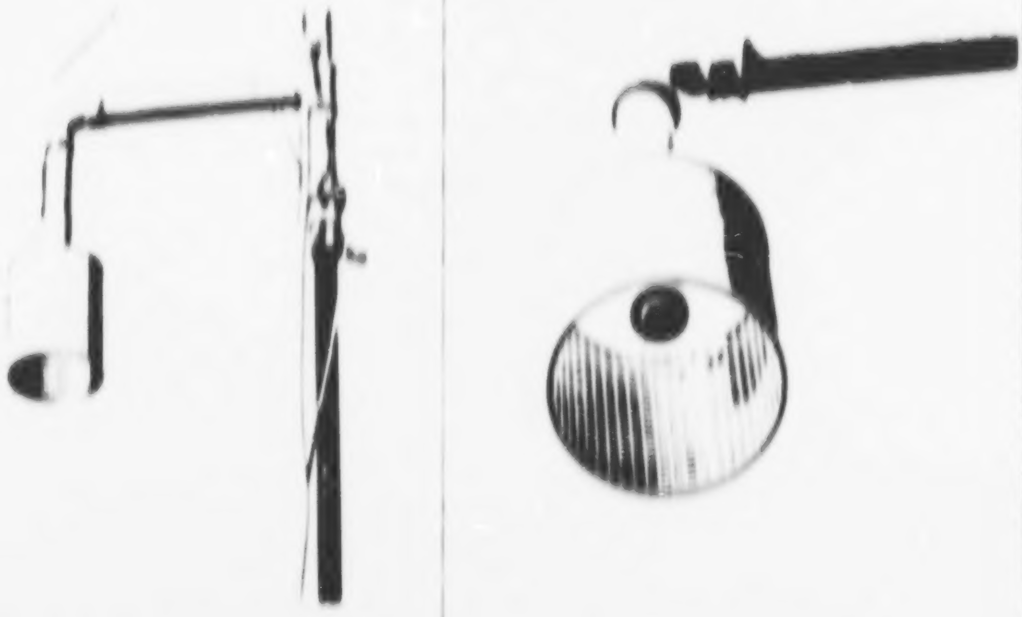


LINEARITY ± 1 dB (3 Hz ... kHz)		[illegible] = 0,0[illegible] dB/°C	[illegible] < [illegible] %
[illegible] ± 0,1 dB [illegible]	[illegible] cylindrical wire mesh	[illegible] [illegible]	[illegible]
PREAMP GAIN 0,995		NOTES	[illegible]

[illegible]

20 dB(A)

PHOTO



REMOTE SITE - EQUIPMENT

SIGNAL CONDITIONING
[illegible]

GAIN RANGE
[illegible]

GAIN SELECTION
[illegible]

DETECTION
Slow [illegible]

DET. TIME CONSTANT
[illegible]

RECORDER
[illegible]

SAMPLE RATE
[illegible]

REMOTE CONTROL
[illegible]

ACOUSTIC CALIBRATION
[illegible]

SYSTEM CALIBRATION
[illegible]

SYSTEM MONITORING
[illegible]

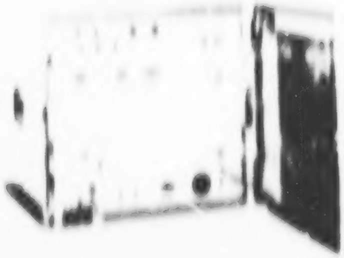
REMOTE CONTROL CAPABILITY
[illegible]

SIZE [illegible]	WEIGHT [illegible]	VOLTAGE [illegible]
CONSTRUCTION	POWER [illegible]	ENVIRONMENTAL [illegible]

CERTIFICATION

PHOTO

[illegible]



[illegible]

NOTES

TRANSMISSION LINK

TYPE
Voice grade telephone line

CHANNELS PER SITE
1

PATH LENGTHS
[illegible]

TRANSMISSION POWER LEVEL
[illegible]

FREQUENCY RESPONSE OF CHANNEL
[illegible] kHz

DYNAMIC RANGE
50 dB (?)

MODEM
[illegible]

MESSAGE RATE
[illegible]

BIT RATE
—

MESSAGE CONTENT
[illegible] Hz

ERROR DETECTION
—

ERROR CORRECTION
—

MESSAGE FORMAT

CENTRAL DATA PROCESSING AND DISPLAY

TYPE OF PROCESSOR

12 bit general purpose computer, Digital PDP-8

SUBSYSTEMS AND EQUIPMENT CONFIGURATION

1. 8K core memory
2. Real time clock
3. TTY teletype ASR 33
4. Interface
5. A/D converter
6. High speed reader & punch

DISPLAYS, ALARMS, MONITORS

1. [illegible]
2. [illegible] alarm to operator (for weekends)
3. Site status indicator

NO. REMOTE SITES	[illegible] SITES
8	4

SIZE

3 x 2 x 1 [illegible]

WEIGHT

POWER

600 VA

INTERFACE

[illegible]

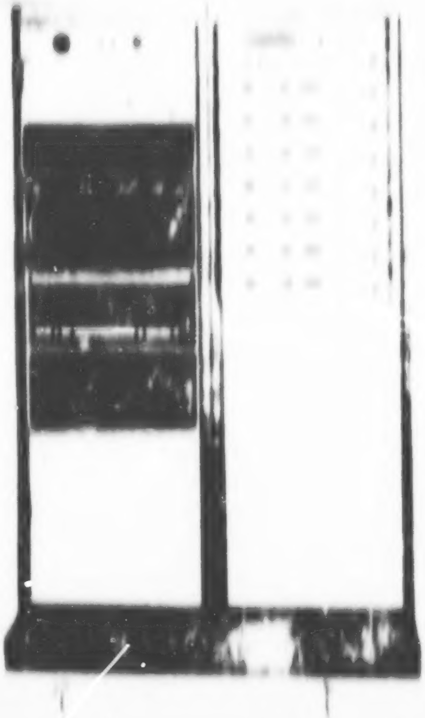
[illegible]

1. [illegible]

TYPE OF CONTROLLED FUNCTIONS

2 [illegible]

PHOTO



NOTES

[illegible]

Real time clock

Interface

A/D converter

High speed reader & punch

Teletype

[illegible]

CENTRAL PROCESSING SOFTWARE

NUMBER WORDS OF PROGRAM	NUMBER WORDS OF DATA
NUMBER WORDS SPARE	PEAK PERCENTAGE UTILIZATION OF COMPUTER
METHOD OF LOADING PROGRAM paper tape	PROVISIONS FOR ERROR MESSAGES Operator inputs standard if erroneous
NUMBER OF OPERATOR INPUTS	

Operator commands are provided for:

1) Input of date } when starting the program
2) Input of time }
3. Changing the threshold NI at each site
4. Changing the reference ([illegible]) NI at each site
5. Asking for the time
6. Asking for the [illegible] separation
7. Asking for the [illegible] pressure [illegible]
8. Readout of threshold NI (of the N sites)
9. Readout of reference NI)
10. ~~[illegible]~~ High speed printout of NI (history) per second for all sites
11. Automatic [illegible] of sites [illegible] printout

TRACKING

TYPE None		
RANGE COVERAGE	RANGE ACCURACY	RANGE RATE
BEARING COVERAGE	BEARING ACCURACY	BEARING RATE
ALTITUDE COVERAGE	ALTITUDE ACCURACY	ALTITUDE RATE
NUMBER TRACKING SITES	LOCATION	
ACTIVE/PASSIVE TARGETS	TRANSPONDER OR BEACON	
ANALOG/DIGITAL RECORDING OF DATA	REAL TIME PLOT OF TARGET	PLOT SCALE
RECORDED DATA ACCURACY	OUTPUT POST-PROCESSING TURNAROUND TIME	PLOT ACCURACY
PROCESSED PLOT OF TARGET	PROCESSED PLOT SCALE	PROCESSED ACCURACY
LINE PRINTER PARAMETERS LISTED		
RATE PARAMETERS ALSO LISTED ON LINE PRINTER		
PHOTO	NOTES	

SYSTEM COST/SCHEDULE

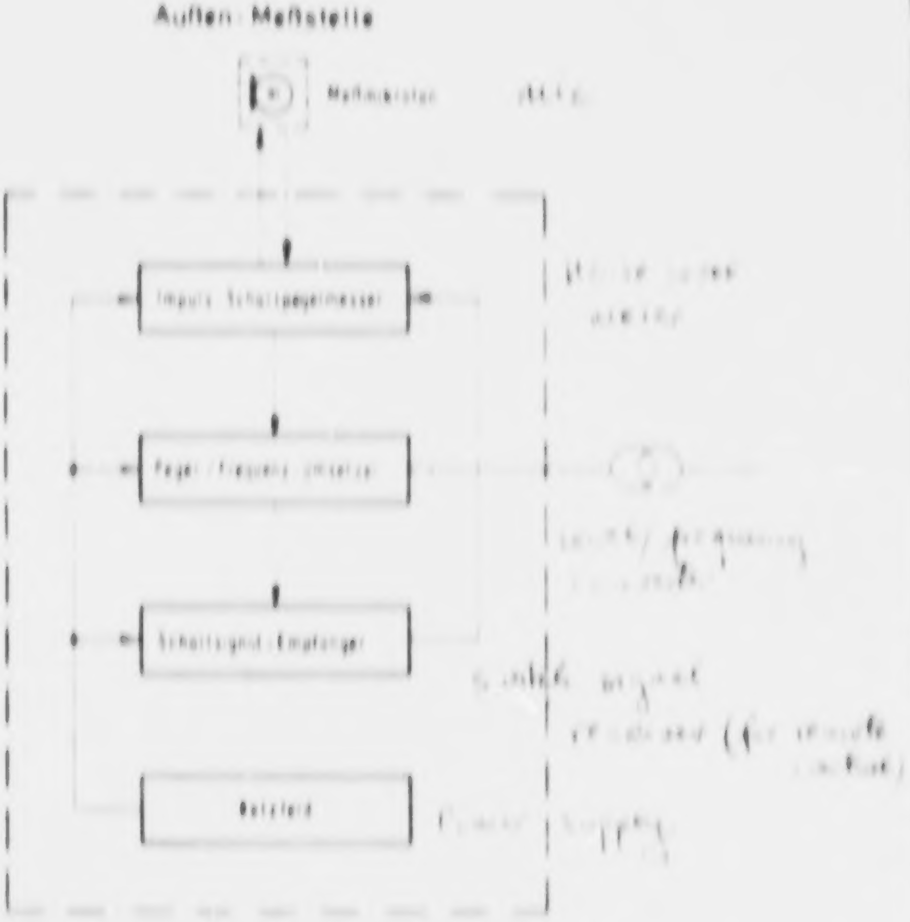
DESIGN COST —	DESIGN MAN-MONTHS —	DESIGN PERIOD —
PROCUREMENT COST DM 360 000.-	PROCUREMENT MAN-MONTHS —	PROCUREMENT PERIOD 6 months
SYSTEM COST INSTALLED	MANUFACTURE MAN-MONTHS —	MANUFACTURE PERIOD —

YEARLY MAINTENANCE COST DM 42 000,-	RENTAL LEASE COST PER YEAR —
OPERATIONS COST DM 15.000,-	LIFE EXPECTANCY
CURRENT REPLACEMENT COST —	
PERSONNEL REQUIRED (IN NUMBER OF PEOPLE) AND MAN-HOURS PER YEAR MAINTENANCE ____ MAN-HOURS ____ OPERATOR } 1 MAN-HOURS } 2000 DATA REVIEW } MAN-HOURS }	

See vol. 2

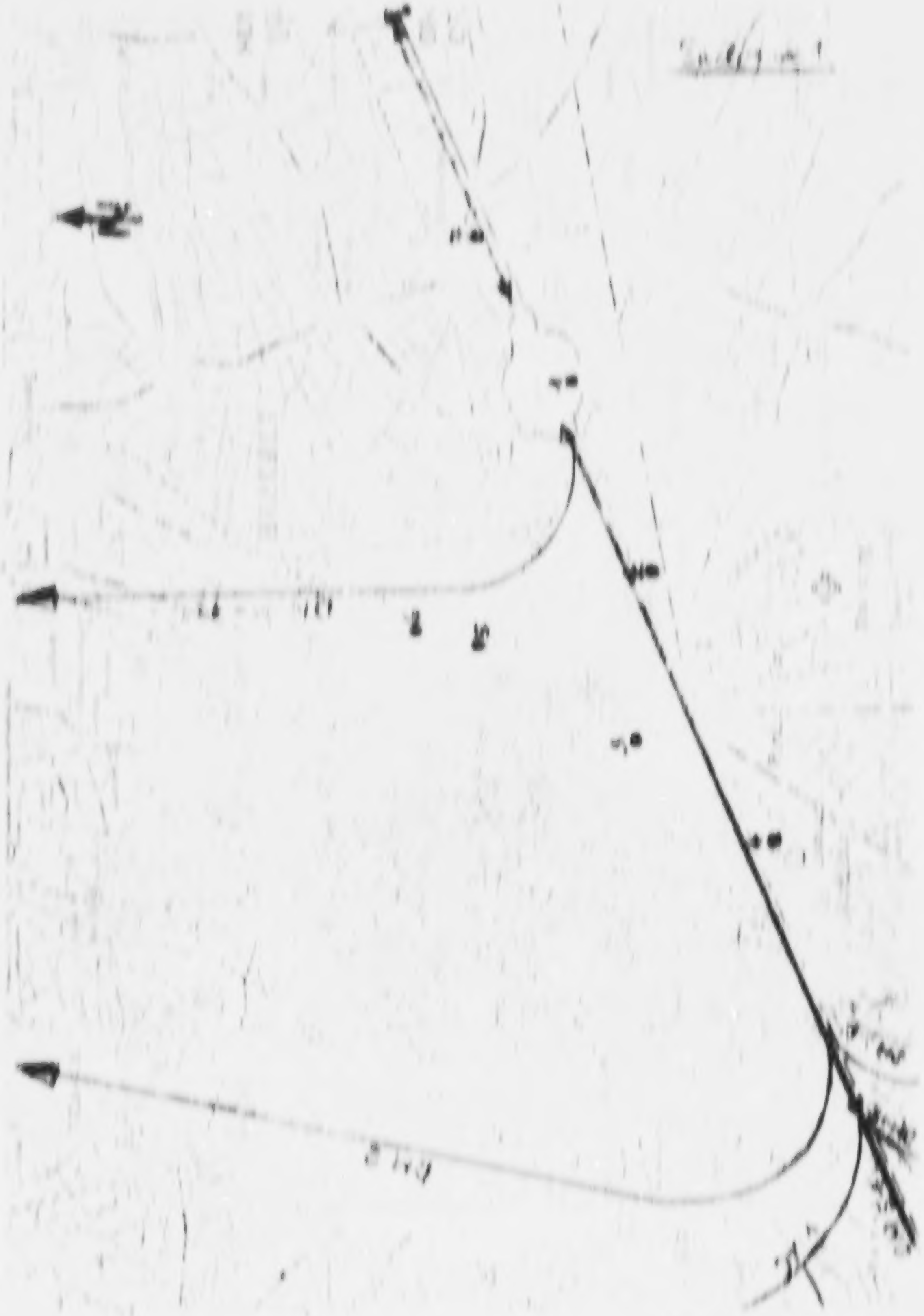
CENTRAL PROCESSING UNIT BLOCK DIAGRAM

REMOTE SITE BLOCK DIAGRAM


Außen-Meßstelle
Meßmikrofon
Impuls-Schallpegelmesser
Pegel-/Frequenz-Umsetzer
Schallsignal-Empfänger
Netzteil
Switch signal
receiver (for remote
control)
Power supply

See encl 3

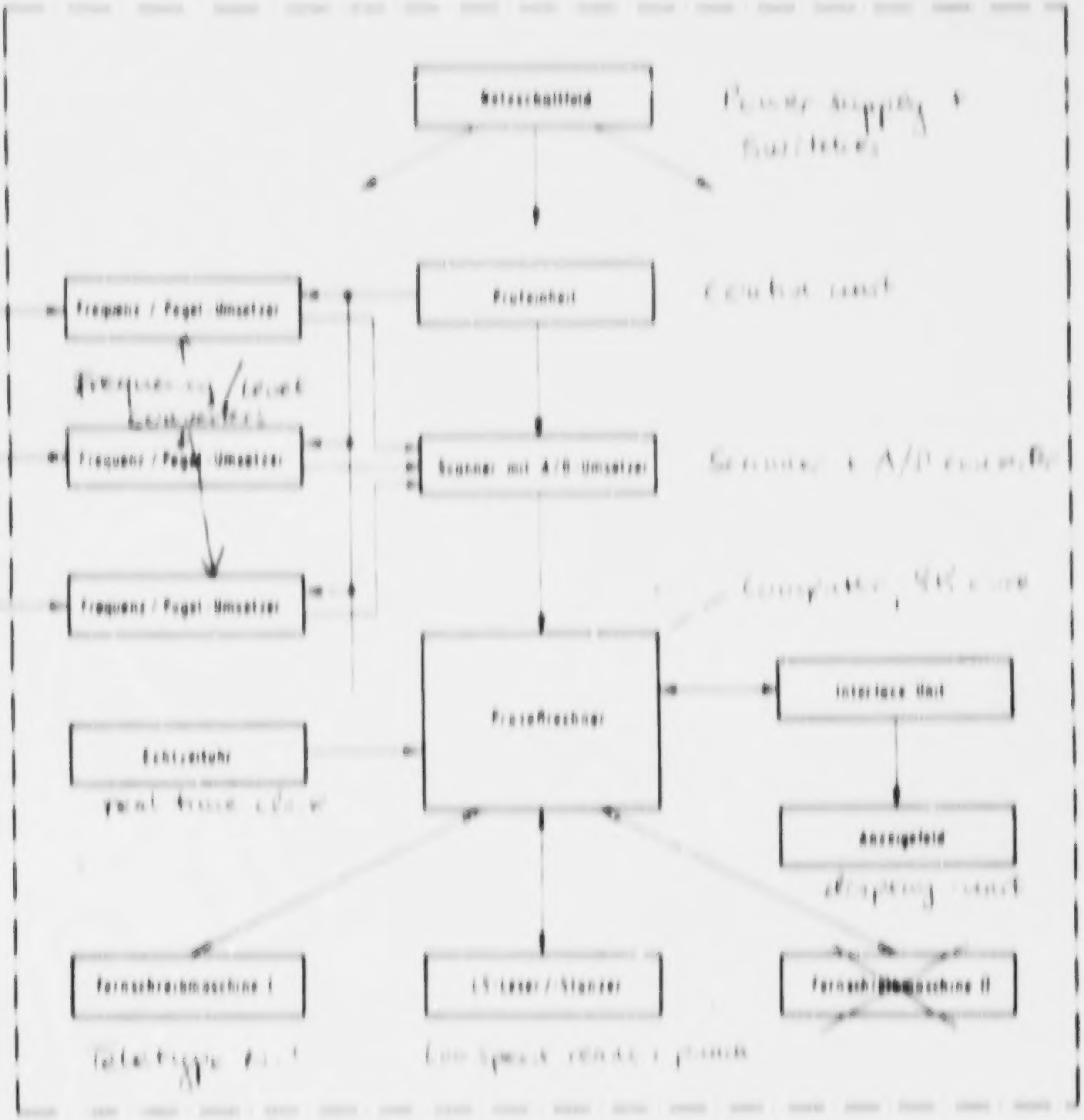
OVERALL SYSTEM BLOCK DIAGRAM



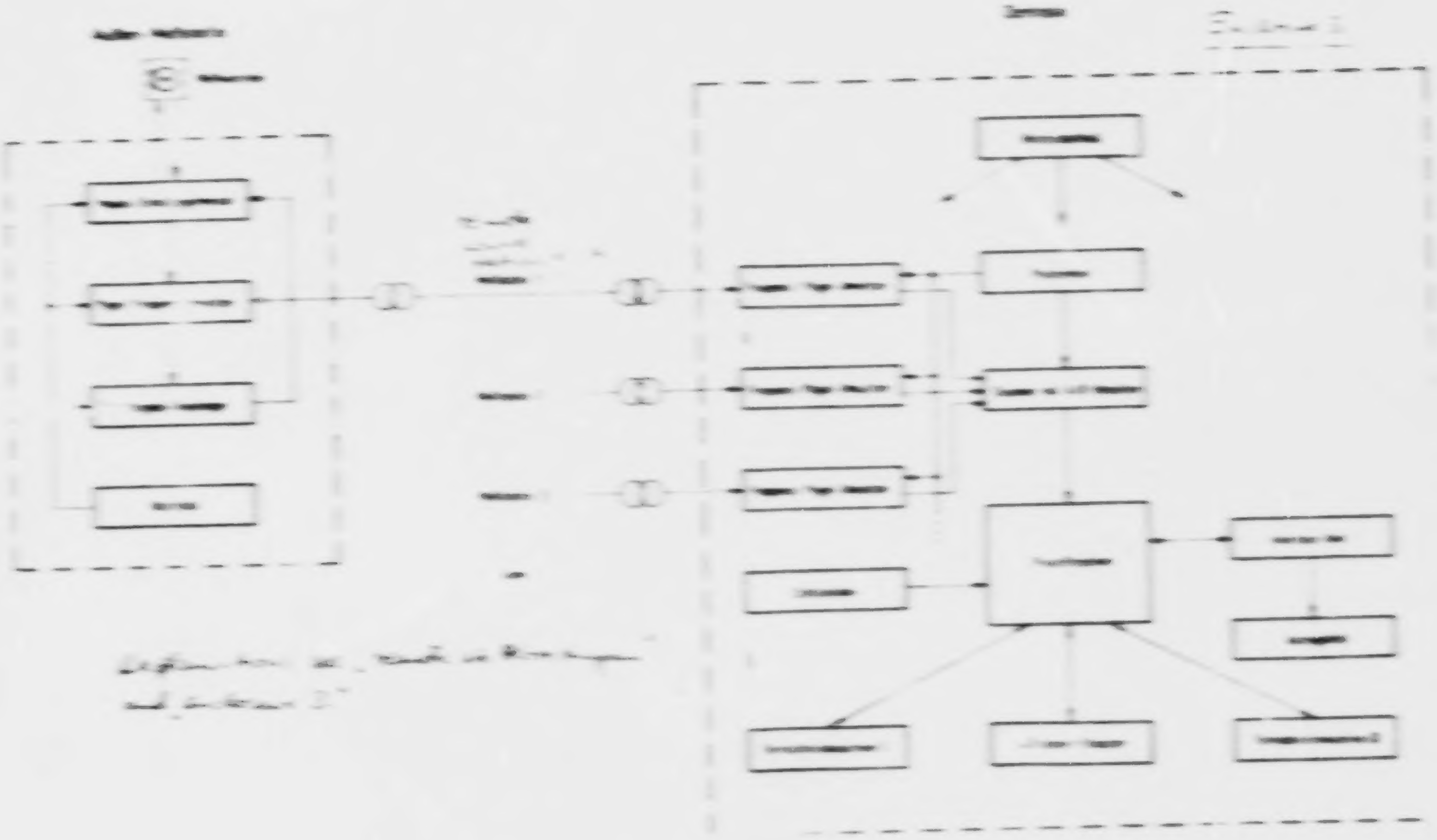
Reproduced from
best available copy.

Enclosure 2

Zentrale


Netzschaltfeld
Power supply + switches
Prüfeinheit
Control unit
Frequenz / Pegel-Umsetzer
Frequency / level converters
Frequenz / Pegel-Umsetzer
Scanner mit A/D-Umsetzer
Scanner + A/D converter
Frequenz / Pegel-Umsetzer
Computer, 4K core
Prozeßrechner
Interface Unit
Echtzeituhr
real time clock
Anzeigefeld
display unit
Fernschreibmaschine I
LS-Leser / Stanzer
Fernschreibmaschine II
Teletype #1
Computer tape reader + punch

Blockschaltbild zur Fluglärm-Überwachungsanlage MFA BN 6546/2



2.5 SAN DIEGO LINDBERGH FIELD

Table III. Airport Location and Physical Features

LOCATION San Diego, California, USA		LATITUDE 32° 44' N	LONGITUDE 117° 11' W
ELEVATION 15 feet	TERRAIN Coastal airport surrounded by 300- to 400-foot hills		
APPROACHES Populated residential and downtown business area			

GENERAL LOCATION MAP

SAN FRANCISCO
LOS ANGELES
SAN DIEGO

TOTAL JET OPS 274/day	DATE INSTALLED February '74	TERMINAL TRACKING ILS Runway 9
DAY 200	VIOLATION LEVEL SITE 1: [illegible] DBA; SITE 2: [illegible] DBA SITE 3: [illegible] DBA	
EVE 58	VIOLATION HISTORY 1. None to date. 2. History of complaints from residences northwest of runway.	
NIGHT 16		
NIGHT RESTRICTIONS See Note ①		

INSTALLATION MAP

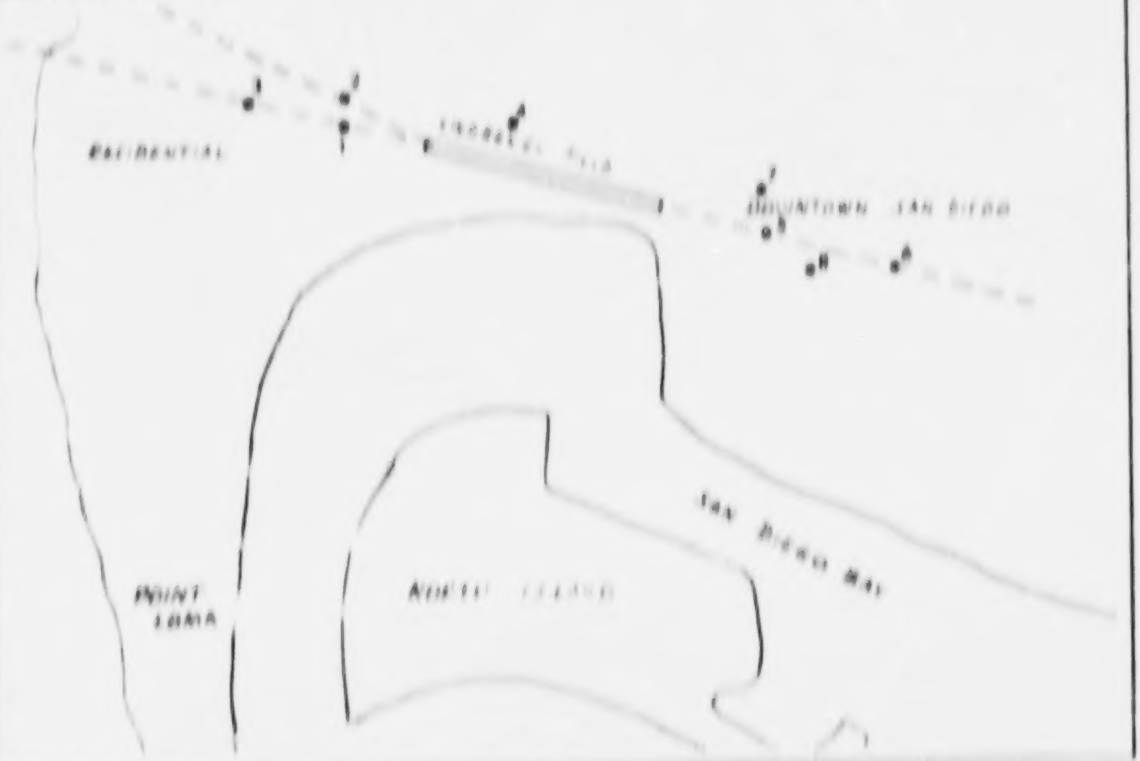

1
2
3
4
5
6
7
8
RESIDENTIAL
TERMINAL AREA
DOWNTOWN SAN DIEGO
SAN DIEGO BAY
POINT LOMA
NORTH ISLAND

Table III. Airport Location and Physical Features, Contd

SYNOPSIS OF SYSTEM

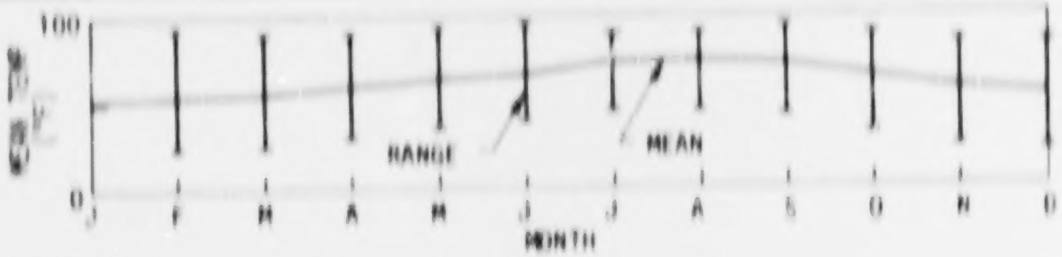
Monitors eight locations continuously as per California Noise Standards (NEL, CNEL, SENEL, dBA). Remote sites are pole-mounted Chesapeake microphones with signal conditioning and digital computation of dBA 2/sec. Transmission is FSK (1070-1270 Hz) of dB value. Single range covers 40-140 dBA. Calibration is by hand-held pistonphone and electrical insert commanded from airport. Raw acoustic signal compressed and sent on second telephone line for aural monitoring at airport. Central monitor is 8K minicomputer which logs hourly, daily, and violations levels. Tower conversations ±10 minutes of violation time are tape recorded. Software and hardware screening used to eliminate non-aircraft noise. Acoustic tracking used to sense traffic pattern direction and set violation limits.

NOTES

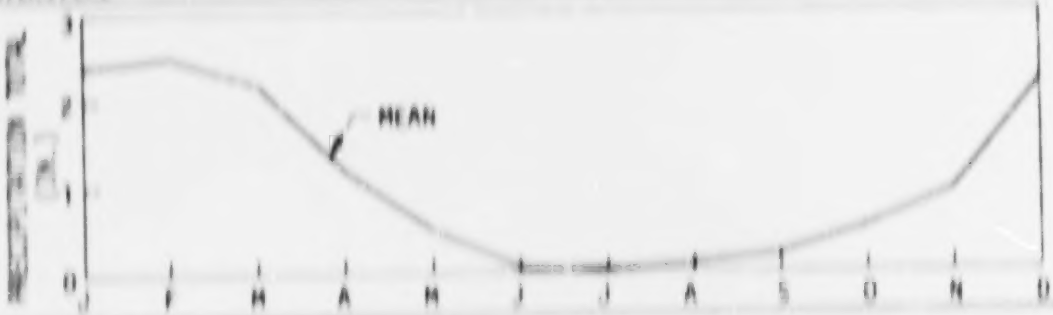
① Curfew between 11 p.m. and 6 a.m. being considered for jet aircraft.

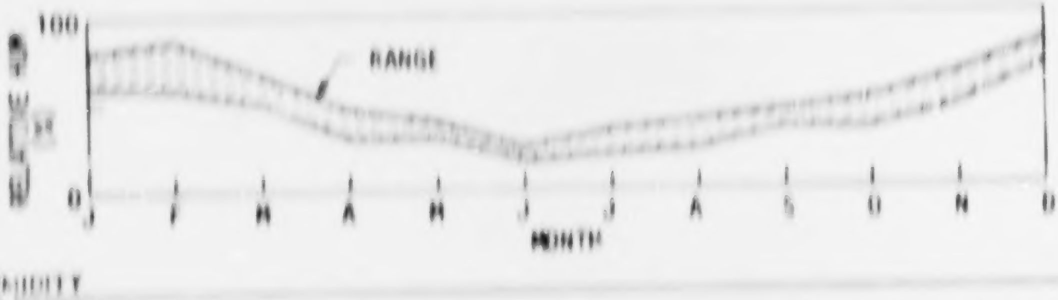
Table IV. Airport Typical Weather Conditions

WEATHER MEASUREMENTS AT AIRPORT U.S. Department of Commerce Weather Service Station	TEMPERATURE 62°F yearly mean
	HUMIDITY 50% yearly mean
	WIND 10 knots yearly mean
	RAINFALL 13 inches yearly mean

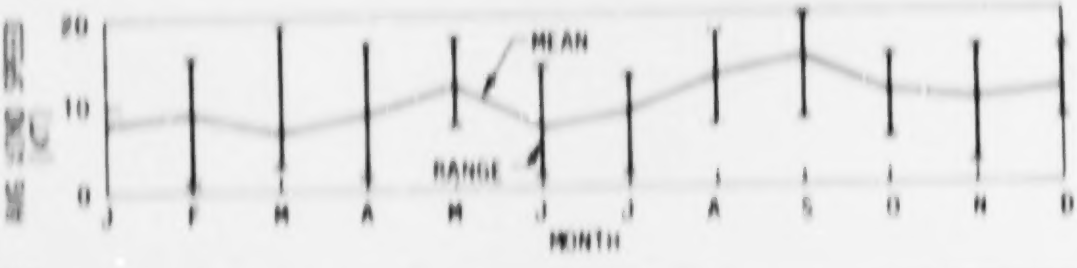


TEMPERATURE





HUMIDITY



WIND

Table V. Total System Performance

NOISE STANDARD, LAW, REGULATION GOVERNING SYSTEM DESIGN

See attached copy of California Noise Standards

UNIT OF NOISE MEASUREMENT

Time-integrated dBA above a threshold - CNEL, HNL, SENEL

RANGE AND RESOLUTION OF NOISE THRESHOLD SETTING

65 to 70 dBA, in 1-dB steps

VIOLATION DETERMINATION

Integrated dBA above a violation threshold of single event - SENEL

VIOLATION THRESHOLD RANGE AND RESOLUTION

Noise levels of 60 to 90 dBA, in 1-dBA steps

VIOLATION LIMIT RANGE AND RESOLUTION

Noise exposure levels of 85 to 125 dBA, in 1-dB steps

ON-LINE/OFF-LINE DATA AVAILABILITY On line	PERCENT OPERATION OF SYSTEM Continuous
TIME TO INSTALL OR ACTIVATE SITE Not applicable	WEATHER RESTRICTIONS AT SITE All-weather operation
DATA USAGE ☒ LITIGATION INVOLVING NOISE LEVELS ☐ PHYSICAL ACOUSTICAL RESEARCH ☒ COMMUNITY RESPONSE ☐ AIRPORT PLANNING ☐ CERTIFICATION OF AIRCRAFT	DATA REVIEWED BY: ☒ AIRPORT OPERATOR ☒ CITY, COUNTY ☒ STATE ☐ FEDERAL ☐ ACOUSTICAL CONSULTANT ☐ ENVIRONMENTAL GROUPS ☐ AIRCRAFT OPERATORS

TOTAL SYSTEM ACCURACY	SYSTEM RESOLUTION	SYSTEM RANGE
±1.2 dBA	0.375 dBA	40-140 dBA

SYSTEM OPTIONS/EXPANDABILITY

Provision included for later expansion to 15 sites

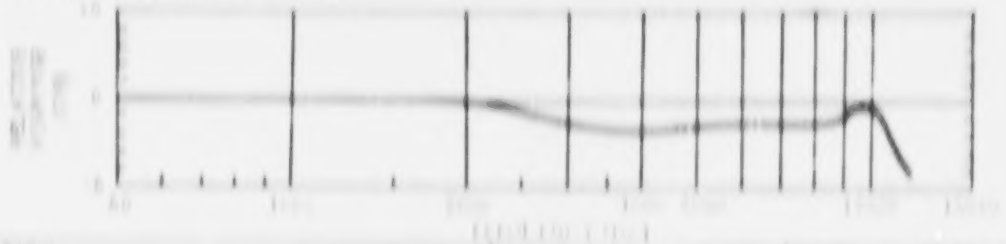
Table VI. Remote Sites - Acoustic Sensors

TYPE
Chesapeake HM 137A

NUMBER
8

INSTALLATION
Pole-mounted, 20-ft min. and 10-ft above obstructions

INSTALLATION FREQUENCY RESPONSE



LINEARITY
±0.25 dB

TEMP COEFFICIENT
0.1%/°F

PRESSURE COEFFICIENT
-

HUMIDITY COEFFICIENT
Not applicable

WINDSCREEN
Polyfoam sphere

BIRD PROTECTION
Nylon spike

LIGHTNING PROTECTION
None

PREAMP GAIN
36 dB

MIN NOISE LEVEL [illegible]
40 dBA

PHOTO

NOTES

① Acoustical axis vertical; vibration damping isolator mount.

② Directivity pattern spherical within 3 dB.

③ Temperature range of operation -50°C to 150°C.

Table VII. Remote Sites - Equipment

SIGNAL CONDITIONING
A-weighting network - special network to detect aircraft noise ①

GAIN RANGES
Single range 40-140 dBA

GAIN SELECTION
N/A

DETECTION Slow responding A-weighting implemented using analog/digital converter and digital processing

RMS - LEQ CONVERSION
Digital computation

MODEM
Frequency shift keying 1070-1270 Hz

SAMPLE RATE	MESSAGE CONTENT
2/sec	8 data bits + 4 status bits + 1 parity + 1 sync

ACOUSTIC CALIBRATION
Hand-held pistonphone placed on mic

INSERT CALIBRATION
1 kHz inserted at mic equal to 130 dBA - on command from central

ACTUAL MONITORING
Raw signal compressed and sent on separate channel 300-3000 Hz bandwidth

REMOTE CONTROLLABLE FUNCTIONS
Insert calibration activated by 500-Hz control tone

SIZE	WEIGHT	TEMP RANGE
10" x 12" x 8"	20 lb	20°F to 120°F
CONSTRUCTION	POWER REQUIREMENTS	TIME OF UNATTENDED OPERATION
Replaceable PC cds	10 watts	Unlimited

COMMUNICATION
Telephone handsets use actual monitoring channel

PHOTO

NOTES

① Narrow filter at 400 Hz with detector, time constant, limiters, and threshold discriminate against cars, trucks, voices, birds, insects, dogs, etc.

② Status bits 1 = non aircraft ①
2 = cal/no cal
3 = on line/off line
4 = spare

Table VIII. Transmission Link

TYPE Voice grade telephone line	
CHANNELS PER SITE 2 half duplex	
PATH LENGTH 6-10 miles through two exchanges	
TRANSMISSION POWER LEVEL 0 dBM into 600 ohms	
FREQUENCY RESPONSE OF CHANNEL 300-3000 Hz	
DYNAMIC RANGE 30 dB maximum with frequent noise burst 20 dB down	
MODEM Freq shift keying	
MESSAGE RATE 2/second	BIT RATE 32/second
MESSAGE CONTENT 14 bits self-clocking pulse width code	
ERROR DETECTION Sync bit, number bits per message, odd parity	
ERROR CORRECTION None in transmission - see data handling	
MESSAGE FORMAT	

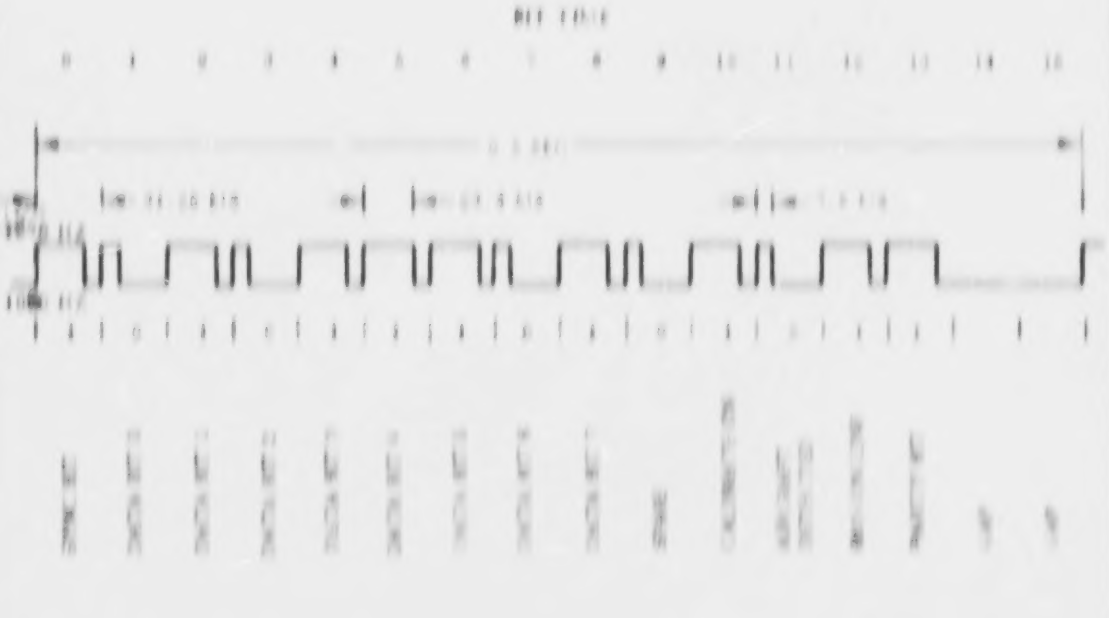


Table IX. Central Data Processing and Display

TYPE OF FACILITY

16-bit general purpose digital computer, Varian 620-i/100

SUBSYSTEMS AND EQUIPMENT CONFIGURATION

1. 8192-word core memory
2. Power fail/restart
3. Eight priority interrupts
4. Real time clock
5. Texas Instrument teleprinter
6. Two Texas Instrument digital tape cassettes
7. Eight telephone modem couplers
8. Tower radio tape recorder

DISPLAYS, ALARMS, MONITORS

1. Panel meters for continuous NL at site
2. Sonalert sound alarm for violations
3. Audio monitor of selected site
4. Teleprinter messages and alarms to operator 2
5. Site status indicator map 1
6. Date and time display

NO. REMOTE SITES 8	**PROVISION FOR NEW SITES** 7
SIZE 6' x 2' x 2'	**WEIGHT** 400 lb
POWER 300 watts	**TEMP RANGE** 400°F - 110°F

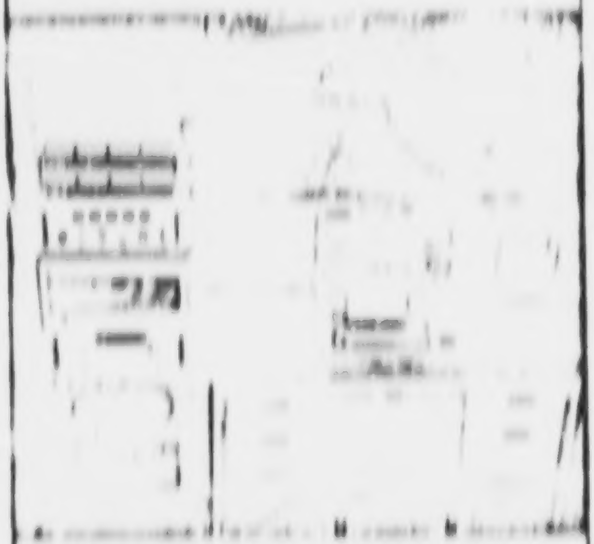
TIME OF UNATTENDED OPERATION

100 hours for teleprinter paper

LOGS

1. Hourly log of HNL for sites
2. Daily log of CNEL for sites
3. Daily calibration of sites
4. Violation levels and time for violation
5. Daily status and status change summary
6. Daily summary of violations

PHOTO



NOTES

1 Map status indicator code:

Steady red light	- out of service
Steady grn light	- in service, no aircraft
Alternating red/grn	- aircraft violation
Blinking grn light	- aircraft noise being accumulated

2 Teleprinter messages:

SENEL violation
Interruption of power
Excessive transmission errors
Change in on-line/off-line site status
Change in duty runway
Post-violation calibration check result
SENEL levels for non-violation aircraft

Table 8. Central Processing Software

NUMBER WORDS OF PROGRAM 4510	NUMBER WORDS OF DATA 3670
NUMBER WORDS SPARE 12	PEAK PERCENTAGE UTILIZATION OF COMPUTER 20% of maximum
METHOD OF LOADING PROGRAM Digital tape cassette	PROVISIONS FOR ERROR CHECKS a. Operator inputs slashed if erroneous b. Time flagged in error after power failures
NUMBER OF OPERATOR INPUTS 21 optional commands 2 computer switch settings	

The 21 operator commands are two-letter mnemonic commands, with trailing numeric parameters where appropriate. They permit assignment of remote sites to HNL and/or SENEL monitoring tasks, adjustment of noise level thresholds and noise exposure level limits, control of the tape recorder, entry of date and time, execution of calibration checks, reprinting of various reports, and insertion of the duty runway (an override option). Once initial entries have been made, no operator intervention is required except to reset the time after a power failure.

One computer switch permits optinal printing of noise exposure levels for non-violation aircraft; the other temporarily delays message output while the printer is off-line (as when paper is replaced).

Table XI. Tracking

TYPE None used at Lindbergh Field①		
RANGE COVERAGE	RANGE ACCURACY	RANGE RATE
BEARING COVERAGE	BEARING ACCURACY	BEARING RATE
ALTITUDE COVERAGE	ALTITUDE ACCURACY	ALTITUDE RATE
NUMBER TRACKING SITES	LOCATION	
ACTIVE/PASSIVE TARGETS	TRANSPONDER OR BEACON	
ANALOG/DIGITAL RECORDING OF DATA	REAL TIME PLOT OF TARGET	PLOT SCALE
RECORDED DATA ACCURACY	LOCATION PROCESSING TERMINAL OF DATA	PLOT ACCURACY
PROCESSED PLOT OF TARGET	PROCESSED PLOT SCALE	PROCESSED ACCURACY
LINE PRINTED PARAMETERS LISTED		
RATE PARAMETERS ARE LISTED ON LINE PRINTER		
PHOTO	NOTES ① Sequence in which acoustic level exceeds thresholds at sites is used to determine runway direction in use	

Table XII. System Cost/Schedule

DESIGN COST *	DESIGN MAN-MONTHS *	DESIGN PERIOD 4 months
PROCUREMENT COST $124,000	PROCUREMENT MAN-MONTHS *	PROCUREMENT PERIOD 3 months
SYSTEM COST INSTALLED $120,000	MANUFACTURE MAN-MONTHS *	MANUFACTURE PERIOD 4 months

YEARLY MAINTENANCE COST $4,000	RENTAL LEASE COST PER YEAR *
OPERATIONS COST *	LIFE EXPECTANCY 20 years
CURRENT REPLACEMENT COST $140,000	
PERSONNEL REQUIREMENTS IN NUMBER PEOPLE AND MAN HOURS PER YEAR MAINTENANCE 1 MAN HOURS 240 OPERATION 1 MAN HOURS 300 DATA REVIEW 1 MAN HOURS 300	

Table XIII. Central Processing Unit Block Diagram

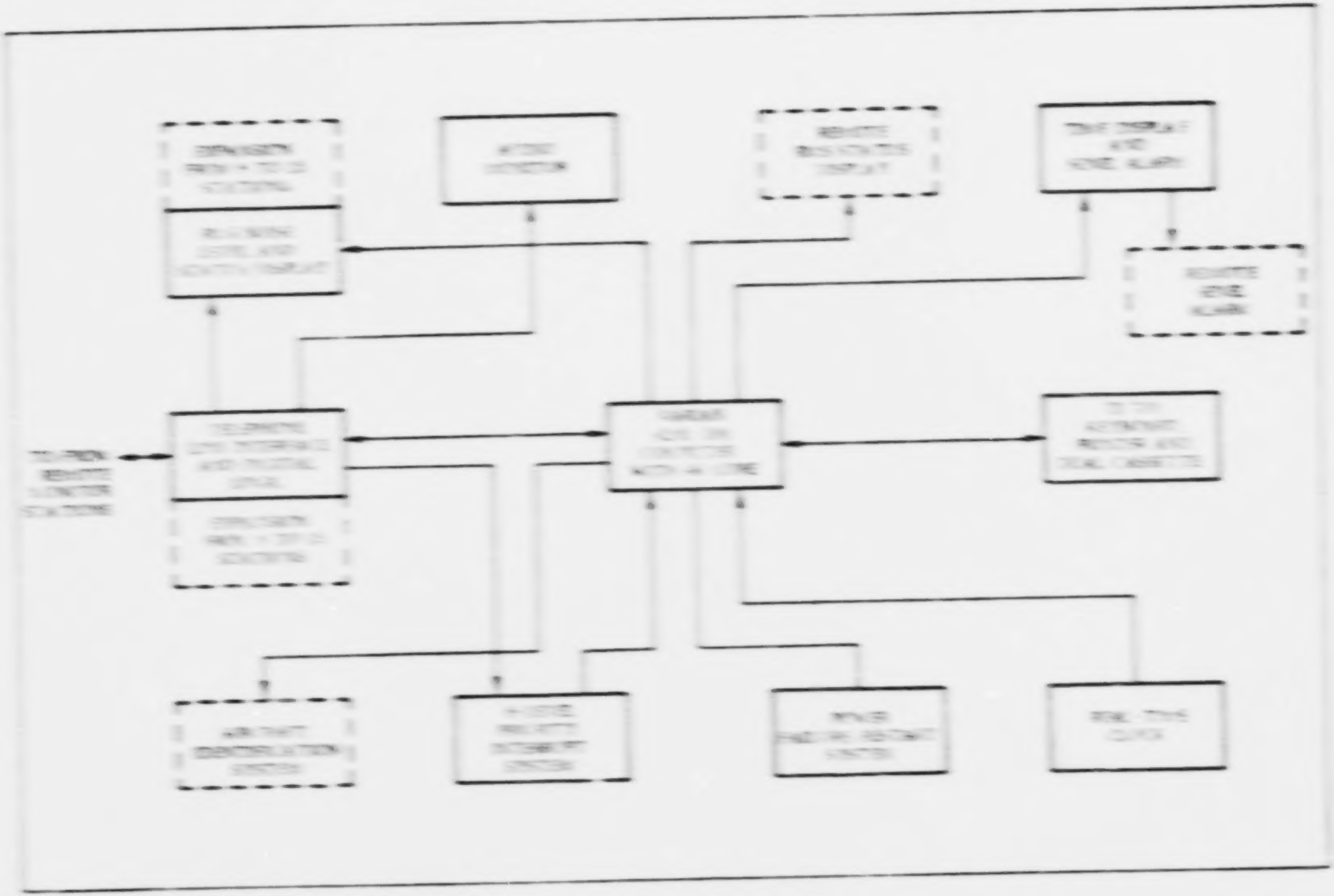

REMOTE ZONE ALARM
TIME DISPLAY AND ZONE ALARM
TO/FROM REMOTE MONITOR STATIONS
AIRCRAFT IDENTIFICATION SYSTEM
POWER FAIL/AUTO RESTART SYSTEM
REAL TIME CLOCK

Table XIV. Remote Site Block Diagram

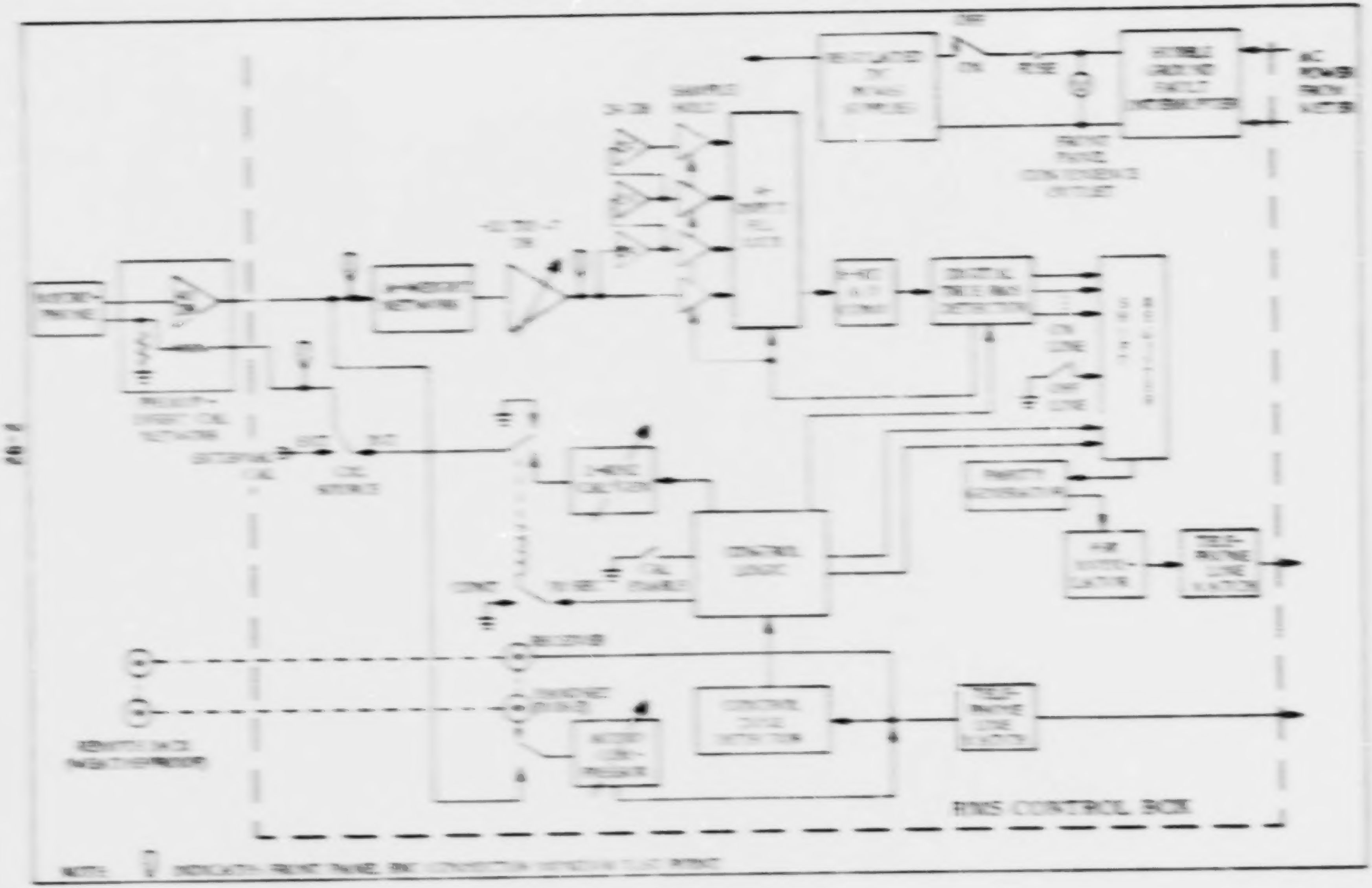
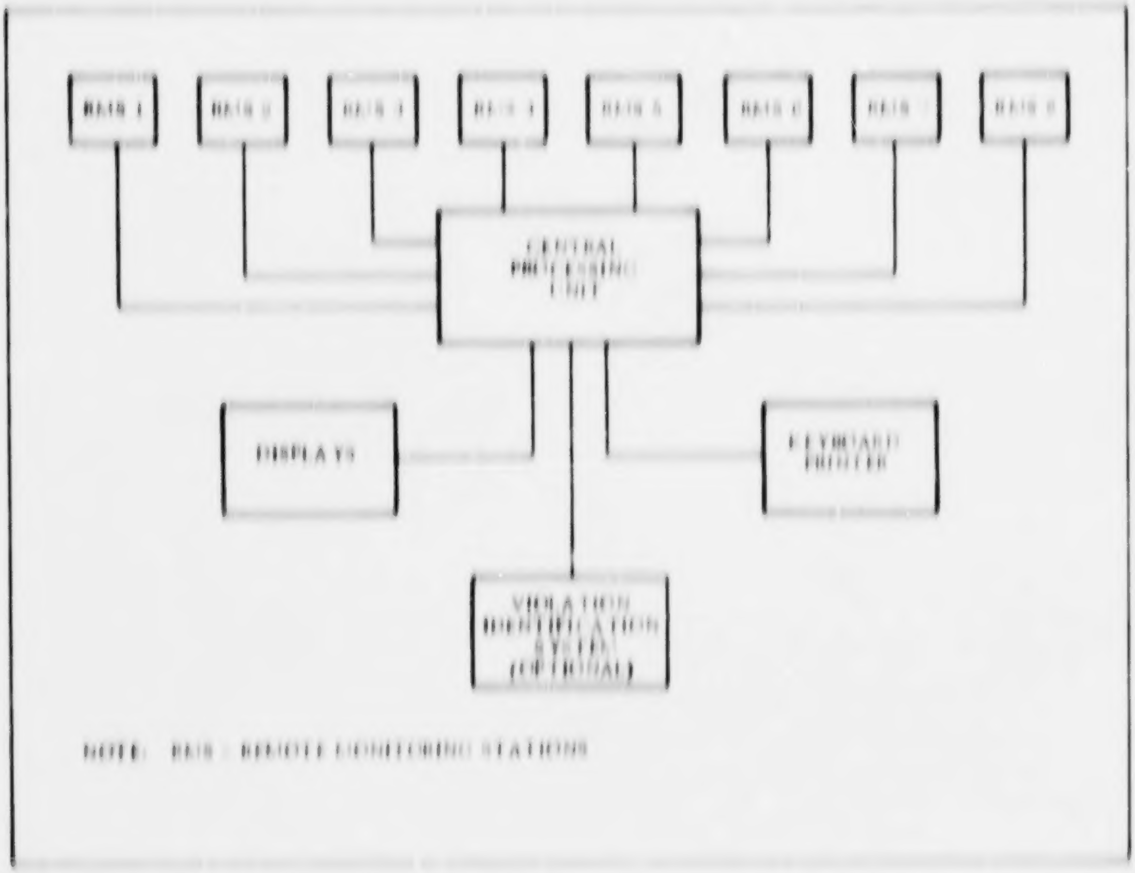

AC POWER FROM METER
GROUND FAULT INTERRUPTER
FRONT PANEL CONVENIENCE OUTLET
OFF
ON
FUSE
SAMPLE HOLD
ON LINE
OFF LINE
PARITY GENERATOR
CONTROL LOGIC
CAL ENABLE
CAL SOURCE
EXTERNAL CAL
RECEIVER
RMS CONTROL BOX

Table XV. Overall System Block Diagram


RMS 1
RMS 2
RMS 3
RMS 4
RMS 5
RMS 6
RMS 7
RMS 8
CENTRAL PROCESSING UNIT
DISPLAYS
KEYBOARD PRINTER
VIOLATION IDENTIFICATION SYSTEM (OPTIONAL)
NOTE: RMS : REMOTE MONITORING STATIONS

2.6 HEWLETT-PACKARD GmbH

HEWLETT PACKARD
HEWLETT-PACKARD GMBH 703 Böblingen Postfach 250 West Germany

Hydrospace-Challenger, Inc.
1360 Rosecrans street,
San Diego
California 92106
U S A

[illegible] [illegible]
BP/ib 910
Purchase [illegible] 12015

15. 7. 74

Subject: Noise Monitoring Systems

Dear Sirs,

I have received your memo regarding your study on noise monitoring at airports.

Unfortunately we are not able to provide you with detailed information on all our installations because we have considerably reduced our activities in noise monitoring.

I am however enclosing a system manual for a typical system.

Our systems are installed and in operation at the following airports:

703 Böblingen Herrenberger Straße 110 Telex 07 265739 Hewl d Telefon 07031 6671

ZURICH/SWITZERLAND

Dynamic range 70 to 120 DB (A)
Threshold fixed at 80 DB (A)
Limit variable 80 to 120 DB(A)
12 remote sites at runway ends.

Data processing:

Events:	max. level duration above theshold duration above limit
Exposure:	hourly, 8-hourly, daily exposure levels, total duration above limit, no. of events. Further processing off-line (second system)

GENEVA/SWITZERLAND

Same as above, 6 remote sites

SYDNEY/AUSTRALIA

Range 40 to 130 DB (A) in three steps,
dynamic range = 50 DB per step
Threshold/limit variable

Data processing:
Events: on-line, with histogram

Exposure: off-line (second system)

STUTTGART/W-GERMANY

Dynamic range 70 - 120 DB(A)

Events: max. level, duration above maximum

Exposure: hourly, 8-hourly, daily noise levels

HEATHROW/UK

Range 40 to 130 in three steps
Threshold, limit variable

Data processing:

Events:	maximum level, duration above maximum. Histogram of events optional.
Exposure:	None
Correlation:	Correlation of flight data with events. Generates weekly and monthly reports showing noise data per airline and per aircraft type, including take-off weight.

GATWICK/UK
MANCHESTER/UK

Same as above, except no correlation.

All Systems:

Data transmission over leased lines, full duplex (data + control), analog transmission, frequency range 500-3300 cps.

Auto-calibration.
Remote sites fully weatherproof.

I hope this quick summary is of help to you.

Yours sincerely

HEWLETT-PACKARD GMBH

Palmer

B. Palmer

ATTN.: Aircraft Noise Monitoring System 80500B

AIRPORT LOCATION AND PHYSICAL FEATURES

LOCATION LOS ANGELES INTERNATIONAL AIRPORT	LATITUDE	LONGITUDE

ELEVATION	TERRAIN

APPROACHES

GENERAL LOCATION MAP	TOTAL JET OPS	DATE INSTALLED	TERMINAL TRACKING
	DAY	THRESHOLD	
	EVE	VIOLATION HISTORY	
	NIGHT		
	NIGHT RESTRICTIONS		

INSTALLATION MAP

SYNOPSIS OF SYSTEM

[illegible]

[illegible]

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AIRPORT TYPICAL WEATHER CONDITIONS

WEATHER MEASUREMENTS AT AIRPORT	TEMPERATURE HUMIDITY WIND RAINFALL

TEMPERATURE

RAIN

HUMIDITY

WIND

TOTAL SYSTEM PERFORMANCE

NOISE STANDARD, LAW, REGULATION GOVERNING SYSTEM DESIGN
CALIFORNIA [illegible]

UNIT OF NOISE MEASUREMENT
d[illegible]

RANGE AND RESOLUTION OF NOISE THRESHOLD SETTING
I 40 - 70, II 60 - 90, III 80 - 110, 1 dB STEPS

VIOLATION DETERMINATION
[illegible]

VIOLATION THRESHOLD RANGE AND RESOLUTION
I 40 - 90, II 60 - 110, III 80 - 1[illegible]0 1 dB [illegible]

VIOLATION LIMIT RANGE AND RESOLUTION
I [illegible] II [illegible] III [illegible] 1 dB [illegible]

ON LINE/OFF LINE DATA AVAILABILITY ON LINE	**PERCENT UTILIZATION OF SYSTEM**
TIME TO INSTALL OR ACTIVATE SITE	**WEATHER REQUIREMENT AT SITE** [illegible]
DATA USAGE ☐ LITIGATION INVOLVING NOISE LEVELS ☐ PHYSICAL ACOUSTICAL RESEARCH ☐ COMMUNITY RESPONSE ☐ AIRPORT PLANNING ☐ CERTIFICATION OF AIRCRAFT	**DATA REVIEWED BY:** ☐ AIRPORT OPERATOR ☒ CITY, COUNTY ☒ STATE ☐ FEDERAL ☐ ACOUSTICAL CONSULTANT ☐ ENVIRONMENTAL GROUPS ☐ AIRCRAFT OPERATORS

TOTAL SYSTEM ACCURACY ± 1 dB [illegible]	**SYSTEM RESOLUTION** 0.1 dB	**SYSTEM RANGE** I 40 TO 90 dB II [illegible] dB III [illegible] TO 130 dB

SYSTEM OPTIONS EXPANDABILITY
[illegible]

REMOTE SITES – ACOUSTIC SENSORS

TYPE HP 15119C	**NUMBER** 1 [illegible]
INSTALLATION [illegible]	
INSTALLATION FREQUENCY RESPONSE 2.5 TO 20,000 HZ	

LINEARITY		**TEMP COEFFICIENT**	**PRESSURE COEFFICIENT**
HUMIDITY COEFFICIENT	**WINDSCREEN**	**BIRD PROTECTION** NO	**LIGHTNING PROTECTION** YES
PREAMP GAIN		**NOTES**	
MIN NOISE LEVEL OF MIC/PREAMP			
PHOTO			

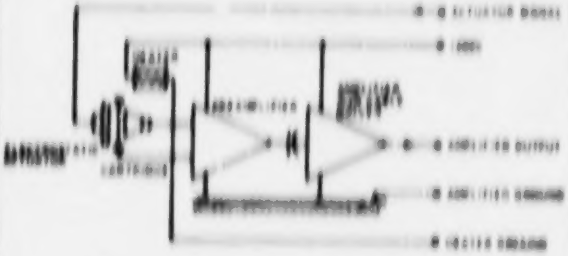


Figure 2-8 Microphone Functions

REMOTE SITES – EQUIPMENT

SIGNAL CONDITIONING
A, B, [illegible]

GAIN RANGES
I 40-[illegible], II [illegible], III [illegible] dB

GAIN SELECTION
[illegible]

DETECTION
[illegible]

RMS – LOG CONVERSION
ANALOG

MODEM
A[illegible] (VOICE [illegible] TELEPHONE)

SAMPLE RATE
–

MESSAGE CONTENT
–

ACOUSTIC CALIBRATION
ELECTROSTATIC [illegible] 84 dBA

INSERT CALIBRATION
A[illegible]

ACTUAL MONITORING

REMOTE CONTROLLABLE FUNCTIONS
[illegible] NORMAL

SIZE
23" × 19" × 25"

WEIGHT

TEMP RANGE

CONSTRUCTION

POWER REQUIREMENTS
115 VAC

TIME OF UNATTENDED OPERATION

COMMUNICATION
TELEPHONE LINE

PHOTO

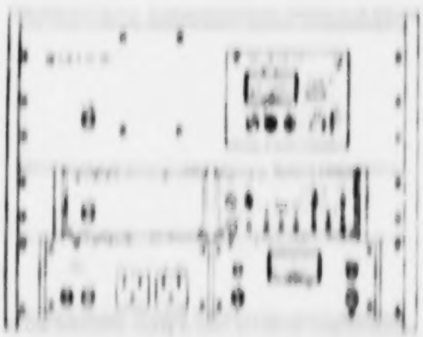


Figure 2-4 Noise Monitoring Terminal – Main Cabinet

40 to 90dB (RANGE I);
60 to 110dB (RANGE II);
80 to 130dB (RANGE III);

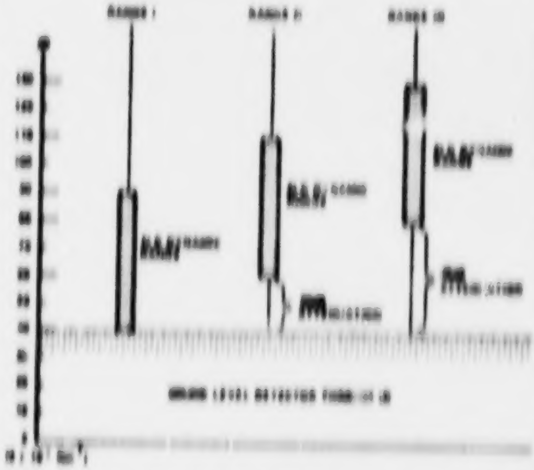


Figure 2-5 Effective System Ranges

TRANSMISSION LINK

TYPE
TELEPHONE LINE

CHANNELS PER SITE
ONE INITIALLY, [illegible]

PATH LENGTHS

TRANSMISSION POWER LEVEL
[illegible]

FREQUENCY RESPONSE OF CHANNEL
[illegible] Hz

DYNAMIC RANGE

MODEM
NONE

MESSAGE RATE
[illegible]

BIT RATE

MESSAGE CONTENT
VARIABLE FREQUENCY 620 TO 3620 Hz

ERROR DETECTION
NO [illegible]

ERROR CORRECTION
NONE

MESSAGE FORMAT

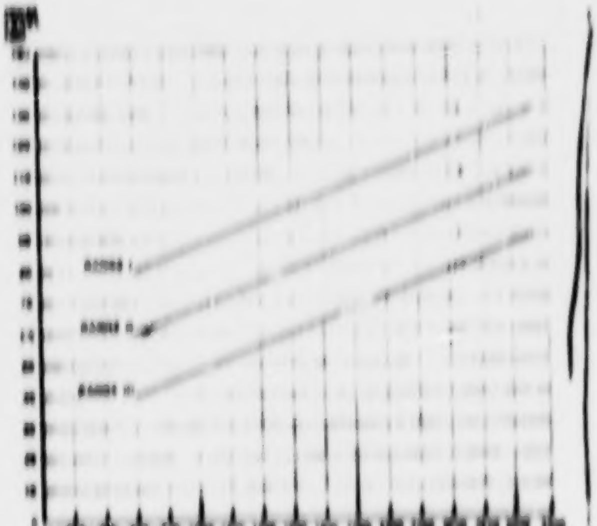


Figure 2-10 NMT Transfer Characteristics

CENTRAL DATA PROCESSING AND DISPLAY

TYPE OF PROCESSOR
HP 2116C [illegible] 16K CORE

SUBSYSTEMS AND EQUIPMENT CONFIGURATION
2 ASR 33 TELEPRINTERS
PAPER TAPE AUTOMATIC
DIALING [illegible]
2 SCANNING [illegible]

DISPLAYS, ALARMS, MONITORS
AUDIO MONITOR
[illegible]
SYSTEM STATUS DISPLAY

NO. REMOTE SITES
15

PROVISION FOR NEW SITES
24 MAX

SIZE
[illegible]

WEIGHT

POWER

TEMP RANGE

LOGS
[illegible]

TIME OF UNATTENDED OPERATION

PHOTO

NOTES
FREQUENCY OF
[illegible]
SIGNALS [illegible]
REMOTE TERMINALS
[illegible]
[illegible] EVERY [illegible]
BY A COMPUTING
FREQUENCY COUNTER

CENTRAL PROCESSING SOFTWARE

NUMBER WORDS OF PROGRAM	NUMBER WORDS OF DATA
NUMBER WORDS SPARE	PEAK PERCENTAGE UTILIZATION OF COMPUTER
METHOD OF LOADING PROGRAM PAPER TAPE	PROVISIONS FOR ERROR MESSAGES NO DATA [illegible]
NUMBER OF OPERATOR INPUTS FIXED INPUTS BELOW PLUS/ 1. MODIFY PARAMETERS 2. REQUEST CALIBRATE 3. REQUEST VERIFICATION	

```
HP AIRCRAFT NOISE MONITORING SYSTEM

** SET THE CLOCK **
** SET SWITCH 15 TO 1 FOR LEAP YEAR **

YEAR???   [71]
ENTER PARAMETERS

PARAMETER          LIMITS
NMS                1,64
RANGE              45,65,80
SETL               RANGE, RANGE+55
LIMIT              RANGE+2?,RANGE+70
HIGL               RANGE,RANGE+80

TOTAL # OF NMS?
[15]

NMS, RANGE, SETL, LIMIT, HIGL
 1,[  ,77,113,82]
 2,[  ,77,113,82]




14,[  ,85,115,78]
15,[  ,95,115,83]

ANL PERIOD XX,XX [  ,  ]
```

Reproduced from best available copy.

Figure 2-30 Test of Operator System Dialogue

TRACKING

TYPE NONE		
RANGE COVERAGE	**RANGE ACCURACY**	**RANGE RATE**
BEARING COVERAGE	**BEARING ACCURACY**	**BEARING RATE**
ALTITUDE COVERAGE	**ALTITUDE ACCURACY**	**ALTITUDE RATE**
NUMBER TRACKING SITES	**LOCATION**	
ACTIVE/PASSIVE TARGETS	**TRANSPONDER OR BEACON**	
ANALOG/DIGITAL RECORDING OF DATA	**REAL TIME PLOT OF TARGET**	**PLOT SCALE**
RECORDED DATA ACCURACY	**OFF LINE PROCESSING TURNAROUND TIME**	**PLOT ACCURACY**
PROCESSED PLOT OF TARGET	**PROCESSED PLOT SCALE**	**PROCESSED ACCURACY**
LINE PRINTER PARAMETERS LISTED		
RATE PARAMETERS ARE LISTED ON LINE PRINTER		
PHOTO	**NOTES**	

SYSTEM COST/SCHEDULE

DESIGN COST	DESIGN MAN MONTHS	DESIGN PERIOD
PROCUREMENT COST	PROCUREMENT MAN MONTHS	PROCUREMENT PERIOD
SYSTEM COST INSTALLED	MANUFACTURE MAN MONTHS	MANUFACTURE PERIOD

YEARLY MAINTENANCE COST	RENTAL/LEASE COST PER YEAR
OPERATIONS COST	LIFE EXPECTANCY
CURRENT REPLACEMENT COST	

PERSONNEL REQUIREMENTS IN NUMBER PEOPLE AND MAN-HOURS PER YEAR

MAINTENANCE ________ MAN-HOURS ________

OPERATION ________ MAN-HOURS ________

DATA REVIEW ________ MAN-HOURS ________

CENTRAL PROCESSING UNIT BLOCK DIAGRAM

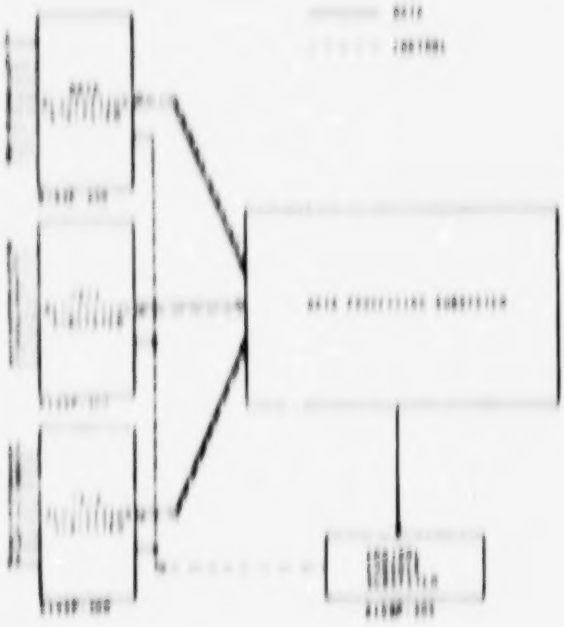

DATA
CONTROL
DATA PROCESSING SUBSYSTEM

Figure 2-18. Central Processing Unit Subsystem Configuration.

REMOTE SITE BLOCK DIAGRAM

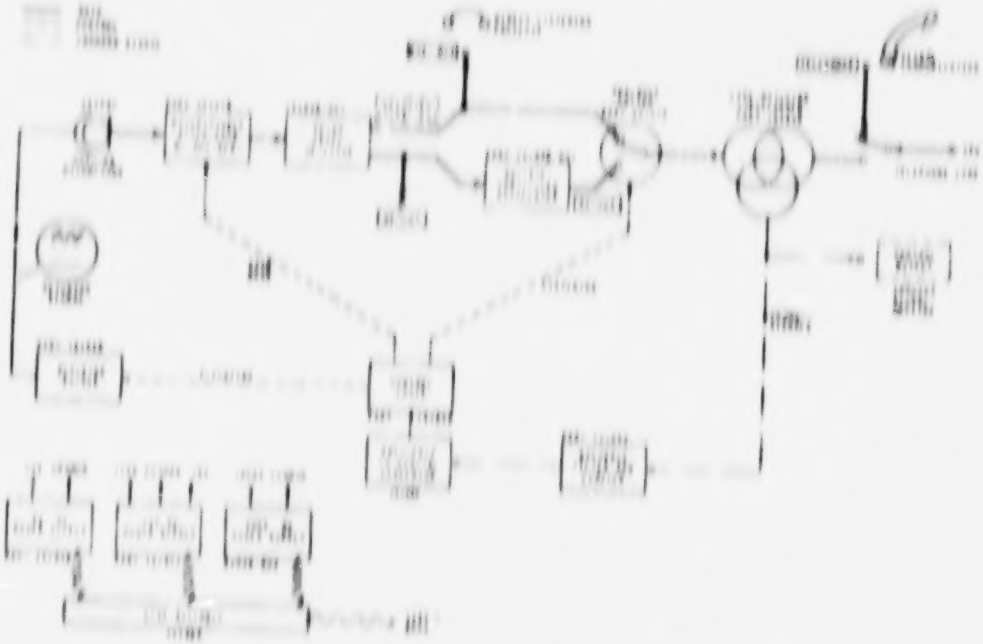


Figure 2-3 Noise Monitoring Terminal – Functional Block Diagram

OVERALL SYSTEM BLOCK DIAGRAM

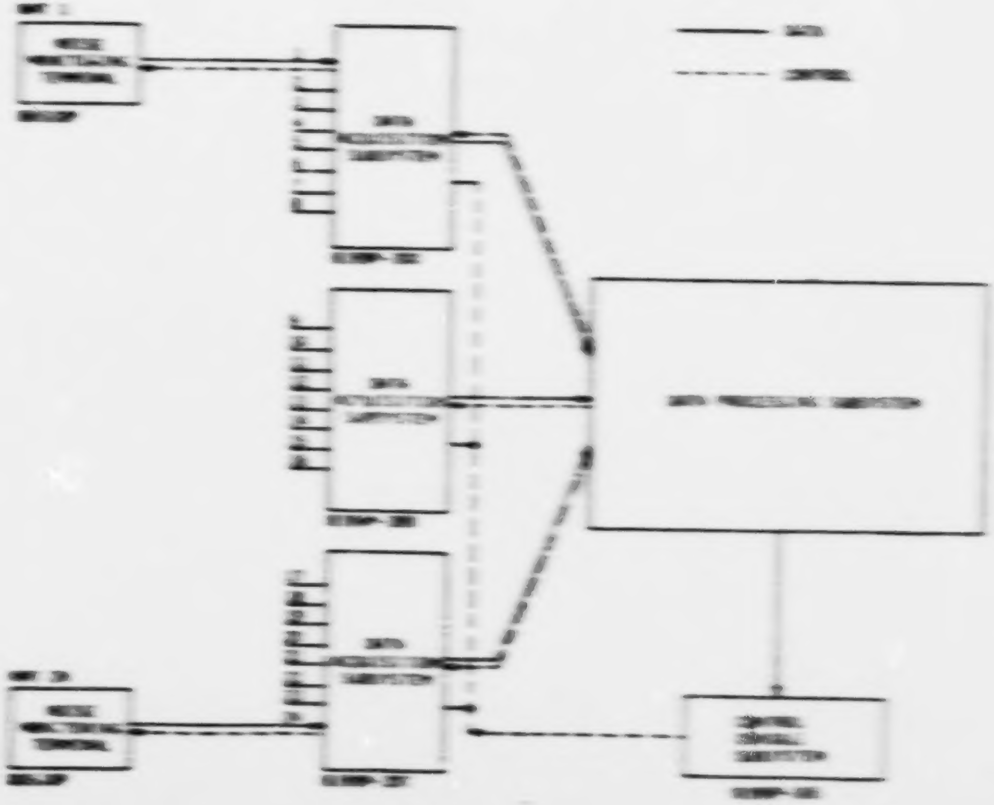

DATA
CONTROL

Figure 2-1 System Configuration

2-1

2.7 B&K INSTRUMENTS

Tel. 216 267-4800

B & K INSTRUMENTS, INC.
Brüel & Kjaer Precision Instruments
5111 West 164th Street • Cleveland, Ohio 44142

July 26, 1974

Mrs. Carole B. Tanner
Project Engineer
Hydrospace Challenger, Inc.
1360 Rosecrans Street
San Diego, Calif. 92106

Dear Mrs. Tanner:

Per your request of July 10, 1974 I am enclosing information on the 8P121 Digital Data System for Noise & Vibration Analysis manufactured by B & K Instruments, Inc.

If you need further information on this system, please contact me.

Sincerely,

Jerry Donovan

Jerry Donovan, P. E.
Environmental Noise Specialist

JD:gls
att.

[illegible] Sound, Vibration & Data Analysis Instrumentation

AIRPORT LOCATION AND PHYSICAL FEATURES, Contd

SYNOPSIS OF SYSTEM

The Digital Data System is comprised of a Digital Data Recorder, Digital Data Translator and Digital Interface coupled to a Tektronix 31 Programmable Calculator. The Digital Data Recorder is a portable self-contained field instrument capable of monitoring and recording (on digital cassette) community noise for extended periods of time. The Digital Data Translator reads the tape cassette through the interface into the programmable calculator or graphic level recorder at an accelerated rate so that several tapes can be analysed in 8 hours. The Digital Interface is compatible with the translator unit and the B & K real-time analyzer for data processing by the calculator. The Tek 31 is an advanced calculator that is easy to program. It has over 40 built-in math functions plus memory expandability and versatility. Community noise data is played back into the calculator for computation of L_N, L_{eq} and other community noise criteria. Expansion of the calculator memory and/or addition of peripheral equipment enables the system to handle more complex programs such as SENEL, DNL & CNEL.

NOTES

TOTAL SYSTEM PERFORMANCE

NOISE STANDARD, LAW, REGULATION COVERED BY SYSTEM DESIGN

UNIT OF NOISE MEASUREMENT linear or A-weighted sound level: L_{eq}, L_N, L_{dn}, mean, standard deviation

RANGE AND RESOLUTION OF NOISE THRESHOLD SETTING With 4921 Outdoor Microphone Unit A-weighted: 45 dB base level; measuring range 45-105 dBA, linear or A-weighted: 60-120 dB; 75-135 dB

VIBRATION DETECTION DATA

VIBRATION THRESHOLD RANGE AND RESOLUTION

VIBRATION LEVEL RANGE AND RESOLUTION

ONLINE OFFLINE DATA AVAILABILITY Off Line	**PERCENT UTILIZATION OF SYSTEM** Continuous
TIME TO INSTALL OR ACTIVATE SITE N/A	**STATION REQUIREMENTS AT SITE** All-weather operation
DATA USAGE ☐ LITIGATION INVOLVING NOISE LEVELS ☐ PHYSICAL ACOUSTICAL RESEARCH ☐ COMMUNITY RESPONSE ☐ AIRPORT PLANNING ☐ CERTIFICATION OF AIRCRAFT	**DATA REVIEWED BY:** ☐ AIRPORT OPERATOR ☐ CITY, COUNTY ☐ STATE ☐ FEDERAL ☐ ACOUSTICAL CONSULTANT ☐ ENVIRONMENTAL GROUPS ☐ AIRCRAFT OPERATORS

TOTAL SYSTEM ACCURACY 0.5 dB	**SYSTEM RESOLUTION** 1 dB	**SYSTEM RANGE** 45-105 dBA 60 - 120 dBA & linear 75-135 dBA & linear

SYSTEM OPTIONS EXPANDABILITY

1. Multiple field recording units can be handled by one base station analysis system;
2. Expanded calculator memory will allow computations of SENEL, HNL & CNE
3. An X-Y Plotter, graphics terminal and hard copy unit are available as calculator options.

REMOTE SITES - ACOUSTIC SENSORS

TYPE B & K 4921 Outdoor Microphone Unit

NUMBER
1/recorder unit

INSTALLATION

As required

INSTALLATION FREQUENCY RESPONSE

+1, -2 dB, 20 Hz to 10KHz } for 0° angle of incidence
+1, -4 dB, 20 Hz to 20 KHz

+0, -4 dB, 20 Hz to 20 KHz for 90° angle of incidence

LINEARITY

TEMP COEFFICIENT

.01 dB/°C

PRESSURE COEFFICIENT

-0,1 dB/100mmHg

HUMIDITY COEFFICIENT

0-1,0% R.H.

WINDSCREEN

woven nylon net cover over specially profiled internal support cone

BIRD PROTECTION

S. S. Spike

LIGHTNING PROTECTION

None

PREAMP GAIN

0 dB

MIN NOISE LEVEL OF MIC PREAMP

32 dBA with external A weighting

PHOTO

NOTES

1. Temperature range:
   -20 to + 50°C (-4 to +122°F)
   -25 to + 70°C (-13 to + 158°F)

REMOTE SITES – EQUIPMENT

SIGNAL CONDITIONING
linear or A-weighting network

GAIN RANGES
45–105 dBA; 60–120 dBA; 75–135 dBA

GAIN SELECTION
manual

DETECTION RMS slow or fast response utilizing an analog-digital converter and digital processing

RMS / LOG CONVERSION

OUTPUT

SAMPLE RATE
variable

MESSAGE CONTENT
8 data bits, 1 time marker bit, 1 extra bits

ACOUSTIC CALIBRATION
remote calibration using electro-static acuater built into microphone rain cover

INSERT CALIBRATION
none

ACTUAL MONITORING AC signal is digitized and stored on mag tape cassette (1)

REMOTE CONTROLLABLE FUNCTIONS
Calibration

SIZE 8 x 9 x 11	WEIGHT 20 lbs	TEMP RANGE standard unit 0-60°C
CONSTRUCTION	POWER REQUIREMENTS 24V battery center tapped lead acid jelly 2.5 amp hours/day @ 120V ac	TIME OF UNATTENDED OPERATION 1 to 10 days

COMMUNICATION
None

PHOTO

NOTES
Mag tape cassette can be replaced daily so that data can be analyzed on a daily basis.

CENTRAL DATA PROCESSING AND DISPLAY

TYPE OF PROCESSOR Programmable Calculator

SUBSYSTEMS AND EQUIPMENT CONFIGURATION

1. B & K Model 182 Digital Data Translator.
2. B & K Model 183 Digital Interface
3. Tektronix 31 Programmable Calculator

DISPLAYS, ALARMS, MONITORS

Thermal printer used to print out L_{dn} mean, standard deviation, NPL, L_N, and a pseudo histogram.

Printer also used in other programs to provide print-out of data.

NO. REMOTE SITES
variable

PROVISION FOR NEW SITES

COST

SIZE
182-8 1/4 x 5 x7 3/4
183- 13 1/4 x 19 1/2 x 3 1/4

WEIGHT
182- 10 lbs
183 - 5 lbs
TEK 31 - 32 lbs

POWER
182-115V, 60Hz, 15VA
183- " " 5VA
TEK 31, 190W

TEMP RANGE
0°C to 50°C

TIME OF UNATTENDED OPERATION

Approximately 1 hour. (1)

PHOTO

NOTES

1. One to 10 days of data, stored on a mag tape cassette, is played back at an accelerated rate and analyzed in 60 minutes.
2. Model 182 is the playback unit.
3. Model 183 also interfaces B & K Model 3347 Real Time Analyzer with the TEK 31.

CENTRAL PROCESSING SOFTWARE

NUMBER WORDS OF PROGRAM Variable	NUMBER WORDS OF DATA Variable
NUMBER WORDS SPARE	PEAK PERCENTAGE UTILIZATION OF COMPUTER
METHOD OF LOADING PROGRAM endless loop tape cassette	PROVISION FOR ERROR MESSAGES Calculator provides 9 error messages
NUMBER OF OPERATOR INPUTS Variable	

SYSTEM COST/SCHEDULE

DESIGN COST

DESIGN MAN MONTHS

DESIGN PERIOD

PROCUREMENT COST
$14,000

PROCUREMENT MAN MONTHS

PROCUREMENT PERIOD
60-90 days

SYSTEM COST INSTALLED
$14,000

MANUFACTURE MAN MONTHS

MANUFACTURE PERIOD

YEARLY MAINTENANCE COST

RENTAL LEASE COST PER YEAR

OPERATIONS COST

LIFE EXPECTANCY

CURRENT REPLACEMENT COST
$14,000

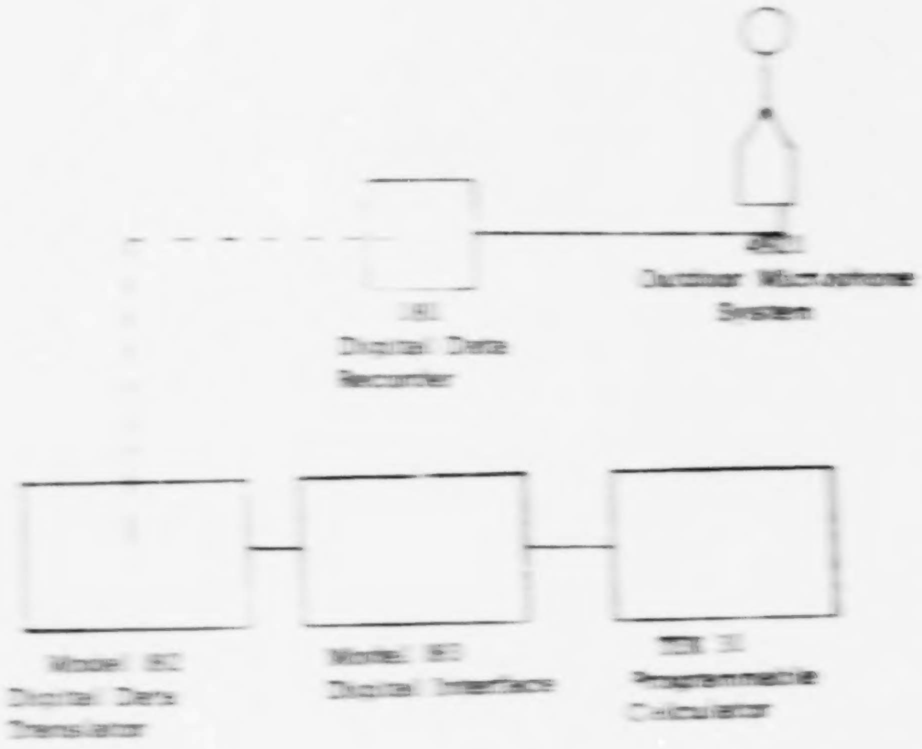
PERSONNEL REQUIREMENTS IN NUMBER PEOPLE AND MAN HOURS PER YEAR

MAINTENANCE ______ MAN HOURS ______

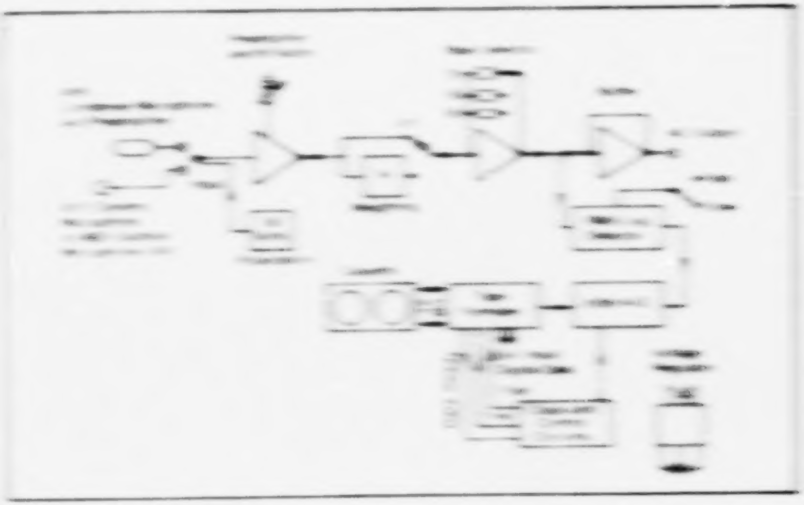
OPERATION ______ MAN HOURS ______

DATA REVIEW ______ MAN HOURS ______

OVERALL SYSTEM BLOCK DIAGRAM

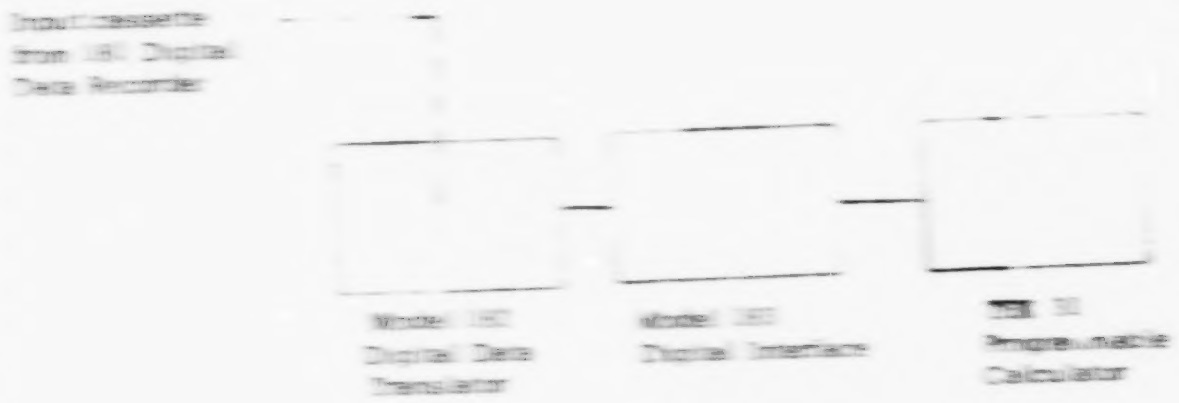

Outdoor Microphone System
Digital Data Recorder
Digital Data Translator
Digital Interface
Programmable Calculator

REMOTE SITE BLOCK DIAGRAM



Model [illegible] Block Diagram

CENTRAL PROCESSING UNIT BLOCK DIAGRAM


Input cassette from [illegible] Digital Data Recorder
Model [illegible] Digital Data Translator
Model [illegible] Digital Interface
[illegible] Programmable Calculator

2.8 TRACOR, INC.

Tracor Sciences & Systems

[illegible]

August 6, 1974

Mrs. Carole S. Tanner
Project Engineer
Hydrospace-Challenger, Inc.
1360 Rosecrans Street
San Diego, California 92106

Dear Mrs. Tanner:

Enclosed is the requested information on the San Jose Noise Monitoring system. Gordon Habel at the San Jose Municipal Airport has supplied most of the information and I have filled in missing details. The response has been delayed somewhat due to my travel commitments; consequently I hope this reaches you in time to meet your requirements.

Tracor has received a contract from the FAA (DOT-FA74WA-3559) which in some phases somewhat parallels your efforts on your EPA contract. We are looking forward to cooperating with you on an exchange of data on existing systems to the extent possible within the framework of our respective schedules.

Sincerely,

B. R. Cooper

B. R. Cooper
Consultant in Acoustics

ll

Enclosures

cc: Gordon Habel w/enc.

AIRPORT LOCATION AND PHYSICAL FEATURES

LOCATION San Jose, California, USA	LATITUDE 37°21'[illegible]"	LONGITUDE 121°55'40"

ELEVATION 53.05 feet	TERRAIN Relatively level with 2000 to 4000 foot mountains 10 to 20 miles to the east and west.

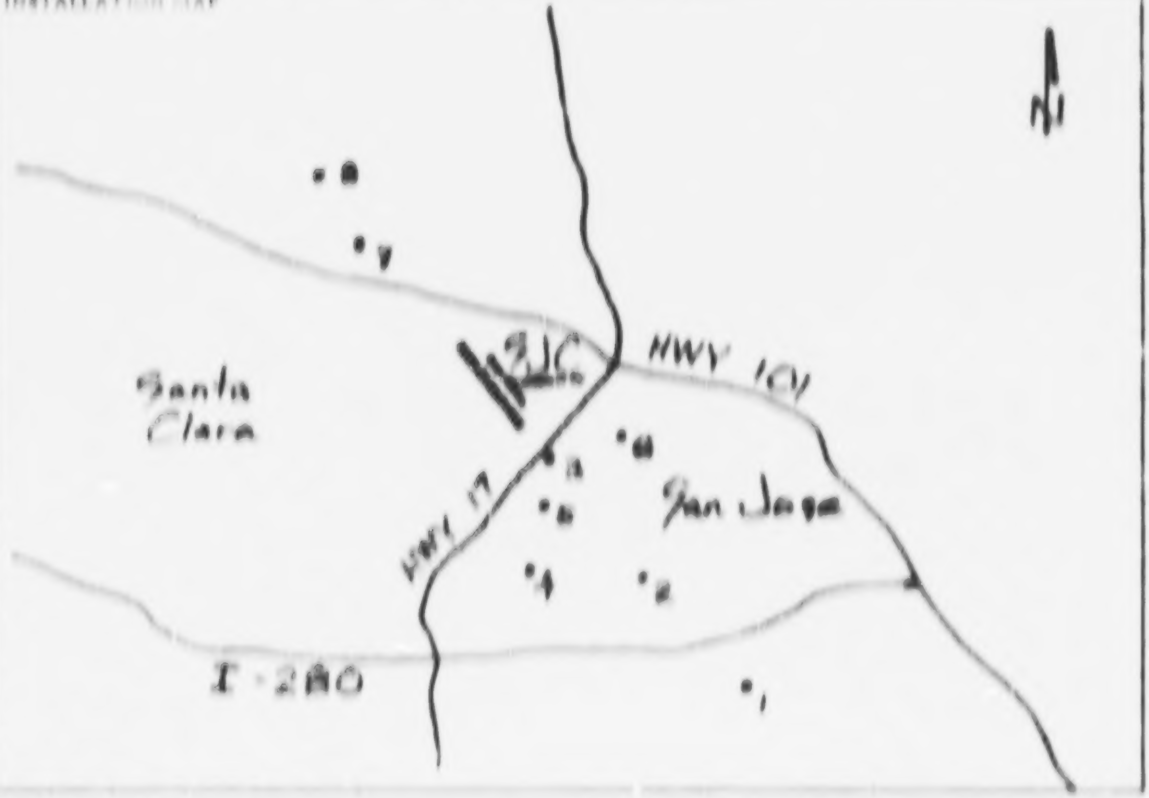
APPROACHES
A mixture of residential, industrial, and farming.

GENERAL LOCATION MAP

San Francisco
San Jose
Los Angeles
San Diego

TOTAL JET OPS 130 /day	DATE INSTALLED November '73	TERMINAL TRACKING/ [illegible]
DAY [illegible]	[illegible]	[illegible]
EVE [illegible]	VIOLATION HISTORY None to date.	
NIGHT 4		
NIGHT RESTRICTIONS See Note ①		

INSTALLATION MAP


N
SJC
HWY 101
Santa Clara
San Jose
HWY 17
I-280
1
2
3
4
5
6
7
8

SYNOPSIS OF SYSTEM

Eight monitor locations continuously per California Noise Std's (NEL, CNEL, SENEL, dBA). Remote sites are pole-mounted [illegible] microphones and digital computation of dBA @ sec. Transmission is FSK (1070-1270 Hz) of dB value. Single range covers 50-130 dBA. Calibration is by hand-held pistonphone and electrical insert commanded from either the site or the airport. Raw acoustic signal compressed and sent on second telephone line for aural monitoring at airport. Central monitor is a 16K minicomputer which logs hourly, daily, and violation levels. Tower conversations are continuously monitored and a log is kept for about one month. Distance screening used to eliminate non-aircraft noise. Acoustic tracking used to sense traffic pattern direction and set violation limits.

NOTES

① Jet traffic between 2400 and 0600 hours is encouraged to use runway approachs and departures to and from the north to avoid downtown and heavy residential areas to the south.

AIRPORT TYPICAL WEATHER CONDITIONS

WEATHER MEASUREMENTS AT AIRPORT

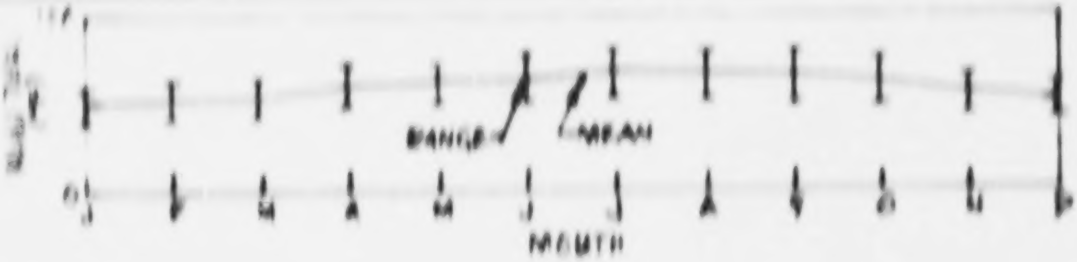
U.S. Department of Commerce, Weather Bureau

TEMPERATURE 59.4°F yearly mean

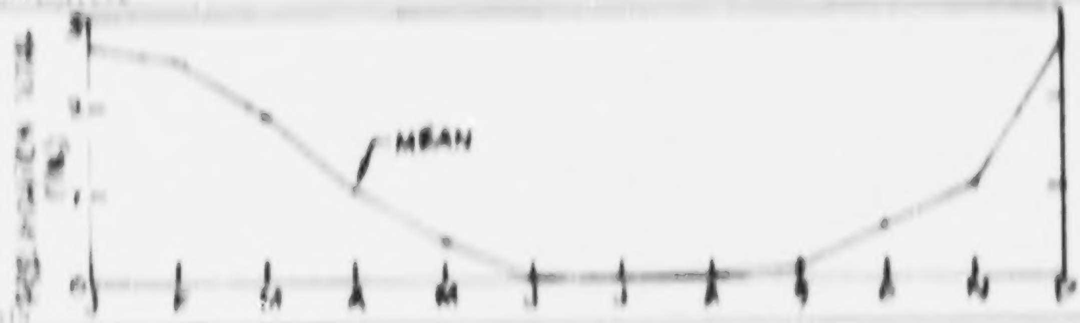
HUMIDITY 55.9% yearly mean

WIND 8.1 Knots yearly mean

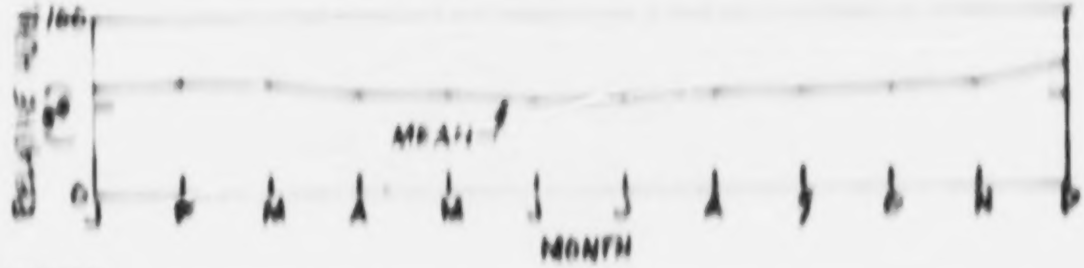
RAINFALL 13.1 inches yearly mean



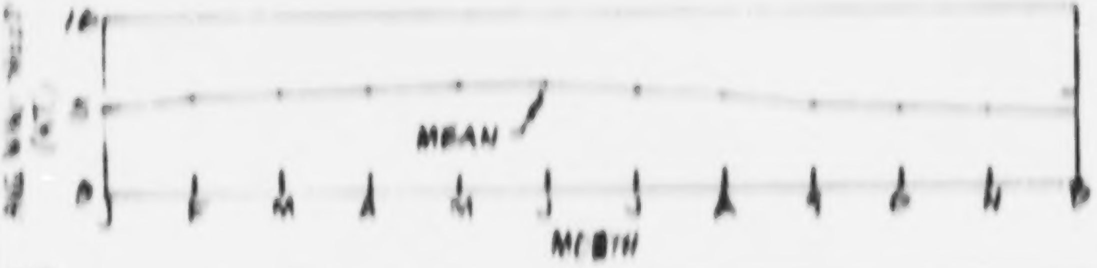
TEMPERATURE



RAINFALL



HUMIDITY



WIND

TOTAL SYSTEM PERFORMANCE

NOISE STANDARD, LAW, REGULATION GOVERNING SYSTEM DESIGN
California Noise Standards

UNIT OF NOISE MEASUREMENT
Time integrated dBA above a threshold - CNEL, HNL, SENEL

RANGE AND RESOLUTION OF NOISE THRESHOLD SETTING
55 to 70 dBA, in 1-dB steps

VIOLATION DETERMINATION
Integrated dBA above a violation threshold of single event - SENEL

VIOLATION THRESHOLD RANGE AND RESOLUTION
Noise levels of 60 to 90 dBA, in 1-dBA steps

VIOLATION LIMIT RANGE AND RESOLUTION
Noise exposure levels 85 to 125 dBA, in 1-dBA steps

ON LINE/OFF LINE DATA AVAILABILITY
On line

PERCENT UTILIZATION OF SYSTEM
Continuous

TIME TO INSTALL OR ACTIVATE SITE
Not applicable

WEATHER REQUIREMENT AT SITE
All-weather operation

DATA USES
- ☒ LITIGATION INVOLVING NOISE LEVELS
- ☐ PHYSICAL ACOUSTICAL RESEARCH
- ☒ COMMUNITY RESPONSE
- ☒ AIRPORT PLANNING
- ☐ CERTIFICATION OF AIRCRAFT

DATA RECEIVED BY:
- ☒ AIRPORT OPERATOR
- ☒ CITY, COUNTY
- ☒ STATE
- ☐ FEDERAL
- ☐ ACOUSTICAL CONSULTANT
- ☐ ENVIRONMENTAL GROUPS
- ☐ AIRCRAFT OPERATORS

TOTAL SYSTEM ACCURACY	SYSTEM RESOLUTION	SYSTEM RANGE
± 1.5 dBA	0.1 dBA	55-130 dBA

SYSTEM OPTIONS/EXPANDABILITY
Provision included for later expansion to 15 sites.

REMOTE SITES – ACOUSTIC SENSORS

TYPE: [illegible] asameake NM 137A

NUMBER: [illegible]

INSTALLATION: Pole mounted and wall mounted, 20 ft min and 10 ft above obstruction

INSTALLATION FREQUENCY RESPONSE: A-weighting per ANSI S1.4-1971

LINEARITY: ± 0.2 dB

TEMP COEFFICIENT: ± 0.5 dB from 20°F to 120°F

PRESSURE COEFFICIENT: —

HUMIDITY COEFFICIENT: < 0.5 dB gain

WINDSCREEN: Stainless steel screen cylinder

BIRD PROTECTION: None

LIGHTNING PROTECTION: None

PREAMP GAIN: [illegible]

NOTES: [illegible]

EIN NOISE LEVEL OF THE PREAMP: 40 dBA

PHOTO

REMOTE SITES - EQUIPMENT

SIGNAL CONDITIONING
A-weighting network

GAIN RANGES
Single range 55-130 dBA

GAIN SELECTION
[illegible]

DETECTION [illegible]

SEL / LEQ CONVERSION
Digital computation

MODEM
Frequency shift keying 1070-1270 Hz

SAMPLE RATE 2 sec.	MESSAGE CONTENT [illegible] ASCII 110 BAUD [illegible]

ACOUSTIC CALIBRATION
Hand held pistonphone placed on microphone

INSERT CALIBRATION
1 kHz inserted at mic equal to 110 dBA - on command from central or site

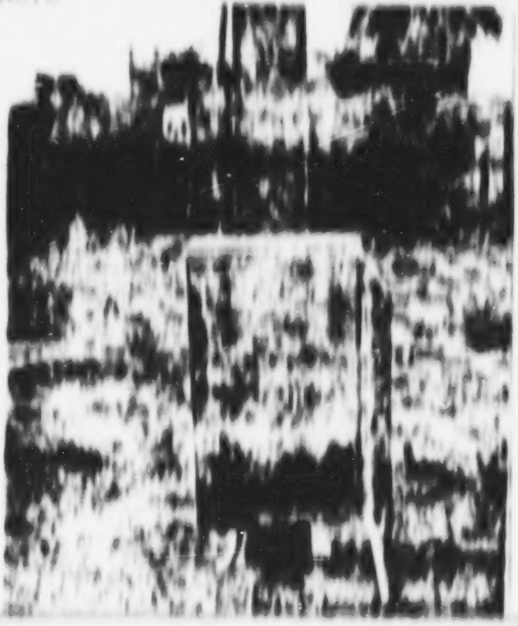
ACTUAL MONITORING
[illegible]

REMOTE CONTROLLABLE FUNCTIONS
Insert calibration activated by FSK ①

SIZE 22"x19"x15"	WEIGHT [illegible]	TEMP RANGE [illegible]
CONSTRUCTION [illegible] PC cards	POWER REQUIREMENTS [illegible]	TIME OF UNATTENDED OPERATION Unlimited

COMMUNICATION
Telephone handset use separate communication line

PHOTO



NOTES

① [illegible]

TRANSMISSION LINK

TYPE
Voice grade telephone line

CONNECTED TO SITE
[illegible]

[illegible]
[illegible]

TRANSMISSION POWER LEVEL
[illegible]

FREQUENCY RESPONSE OF CHANNEL
[illegible]

DYNAMIC RANGE
[illegible]

MODEM
Frequency shift Keying

MESSAGE RATE
2/second

BIT RATE
110/second

MESSAGE CONTENT
(11 bits/character) 5 characters

ERROR DETECTION
[illegible]

ERROR CORRECTION
[illegible]

MESSAGE FORMAT

ASCII 110 BAUD

5 CHARACTER WORD

1 WORD [illegible] EACH ½ SECOND

[illegible] WORD [illegible] OF THE ACTUAL SOUND LEVEL TO A [illegible] OF 0.1 dB AND A [illegible] FOR A SYNC CHARACTER

EX

110.0 LF 111.2 LF

WORD

110.0 [illegible] 111.2 [illegible]

CENTRAL DATA PROCESSING AND DISPLAY

TYPE OF PROCESSOR

16 bit general purpose digital computer, Data General - Nova 1220

SUBSYSTEMS AND EQUIPMENT CONFIGURATION

1. 16,384 word core memory
2. Power fail/restart

DISPLAYS, ALARMS, MONITORS

1. Panel meters for continuous NL at site.
2. Alarm for violations
3. Audio monitor of selected site.
4. Teleprinter messages and alarms to operator ①
5. Site activity indicator map.
6. Date and time display.

NO. REMOTE SITES

8

PROVISION FOR NEW SITES

7

SIZE

[illegible]

WEIGHT

400 lb

POWER

[illegible]

TEMP RANGE

50° F - 100° F

TIME OF UNATTENDED OPERATION

[illegible]

LOGS

1. Hourly log of HNL for sites
2. Daily log of CNEL for sites
3. Daily calibration of sites.
4. Violation levels, violation histogram and time for violation.
5. Daily summary of violations

PHOTO

NOTES

① Teleprinter messages:
SENEL violation
Interruption of power
Change in duty runway
Post violation calibration
SENEL levels and histogram for non-violation aircraft

(2) [illegible]

(3) [illegible]

CENTRAL PROCESSING SOFTWARE

NUMBER WORDS OF PROGRAM 9635	NUMBER WORDS OF DATA 8929
NUMBER WORDS SPARE 820	PEAK PERCENTAGE UTILIZATION OF COMPUTER 80%
METHOD OF LOADING PROGRAM Digital paper tape	PROVISIONS FOR ERROR MESSAGES 1. [illegible] INPUT [illegible] [illegible] 2. [illegible]
NUMBER OF OPERATOR INPUTS 28 optional commands	

TYPE None used at San Jose Municipal Airport ①		
RANGE COVERAGE	RANGE ACCURACY	RANGE RATE
BEARING COVERAGE	BEARING ACCURACY	BEARING RATE
ALTITUDE COVERAGE	ALTITUDE ACCURACY	ALTITUDE RATE
NUMBER TRACKING SITES	LOCATION	
ACTIVE/PASSIVE TARGETS	TRANSPONDER OR BEACON	
ANALOG/DIGITAL RECORDING OF DATA	REAL TIME PLOT OF TARGET	PLOT SCALE
RECORDED DATA ACCURACY	OFF LINE PROCESSING TURNAROUND TIME	PLOT ACCURACY
PROCESSED PLOT OF TARGET	PROCESSED PLOT SCALE	PROCESSED ACCURACY
LINE PRINTER PARAMETERS LISTED		
RATE PARAMETERS ARE LISTED ON LINE PRINTER		
PHOTO	NOTES ① Sequence in which acoustic level exceeds thresholds at sites is used to determine runway direction in use.	

SYSTEM COST/SCHEDULE

DESIGN COST	DESIGN MAN-MONTHS	DESIGN PERIOD
PROCUREMENT COST	PROCUREMENT MAN-MONTHS	PROCUREMENT PERIOD
SYSTEM COST INSTALLED $130,000	MANUFACTURE MAN-MONTHS	MANUFACTURE PERIOD

YEARLY MAINTENANCE COST $5,600	RENTAL/LEASE COST PER YEAR
OPERATIONS COST	LIFE EXPECTANCY [illegible] YEARS
CURRENT REPLACEMENT COST $160,000	

PERSONNEL REQUIREMENTS IN NUMBER PEOPLE AND MAN-HOURS PER YEAR

MAINTENANCE 1 MAN-HOURS 600

OPERATION 1 MAN-HOURS 100

DATA REVIEW 1 MAN-HOURS 100

CENTRAL PROCESSING UNIT BLOCK DIAGRAM

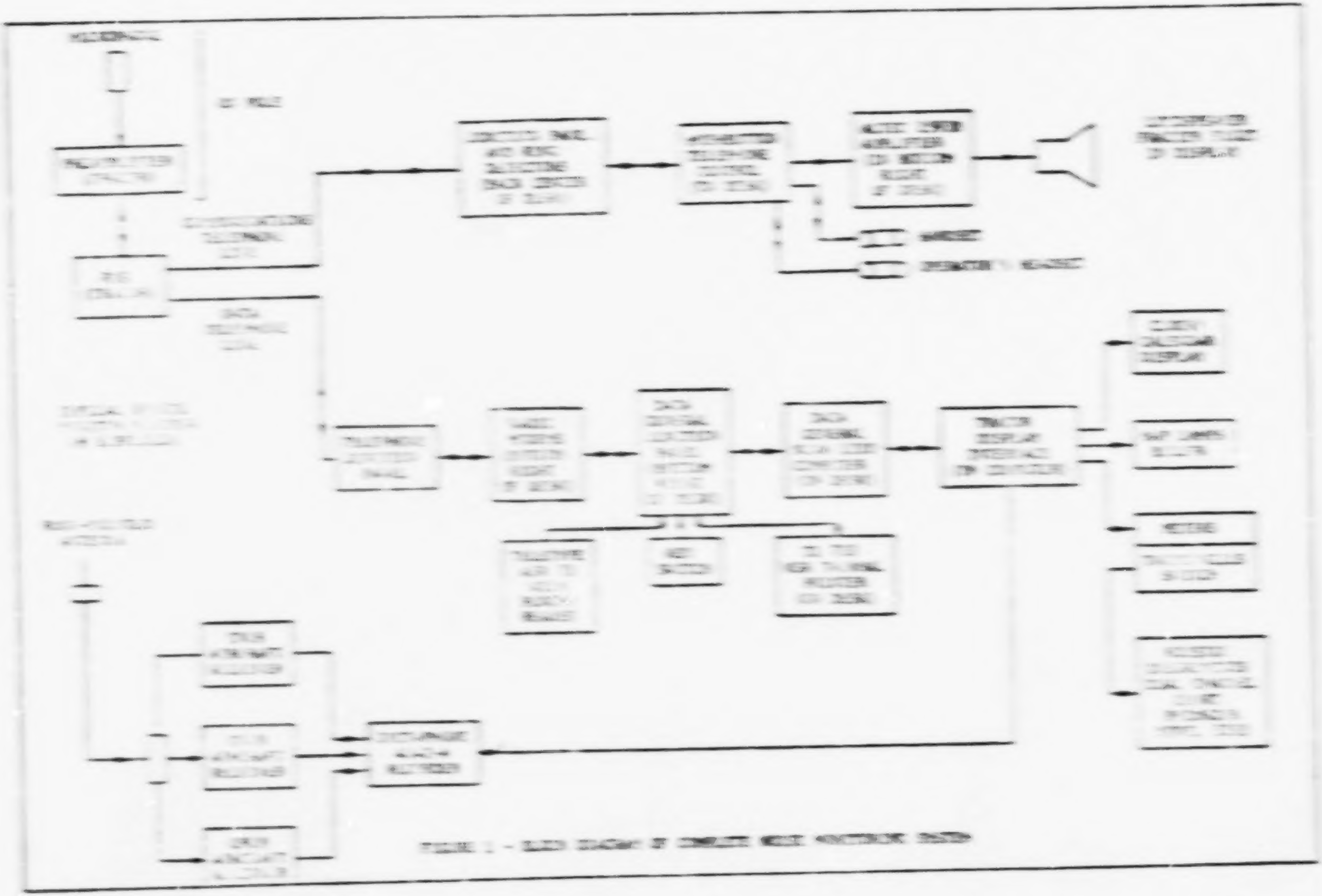
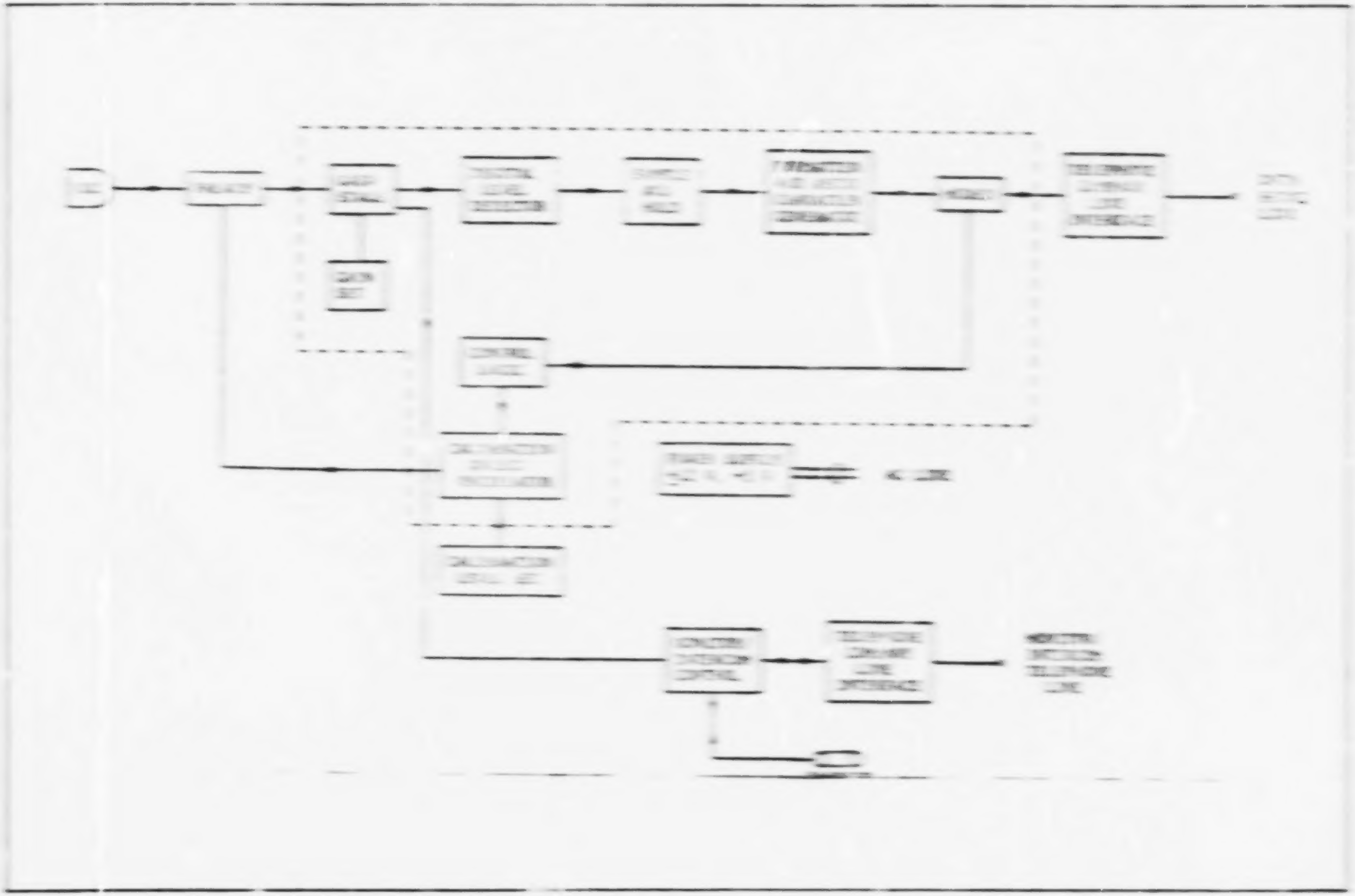
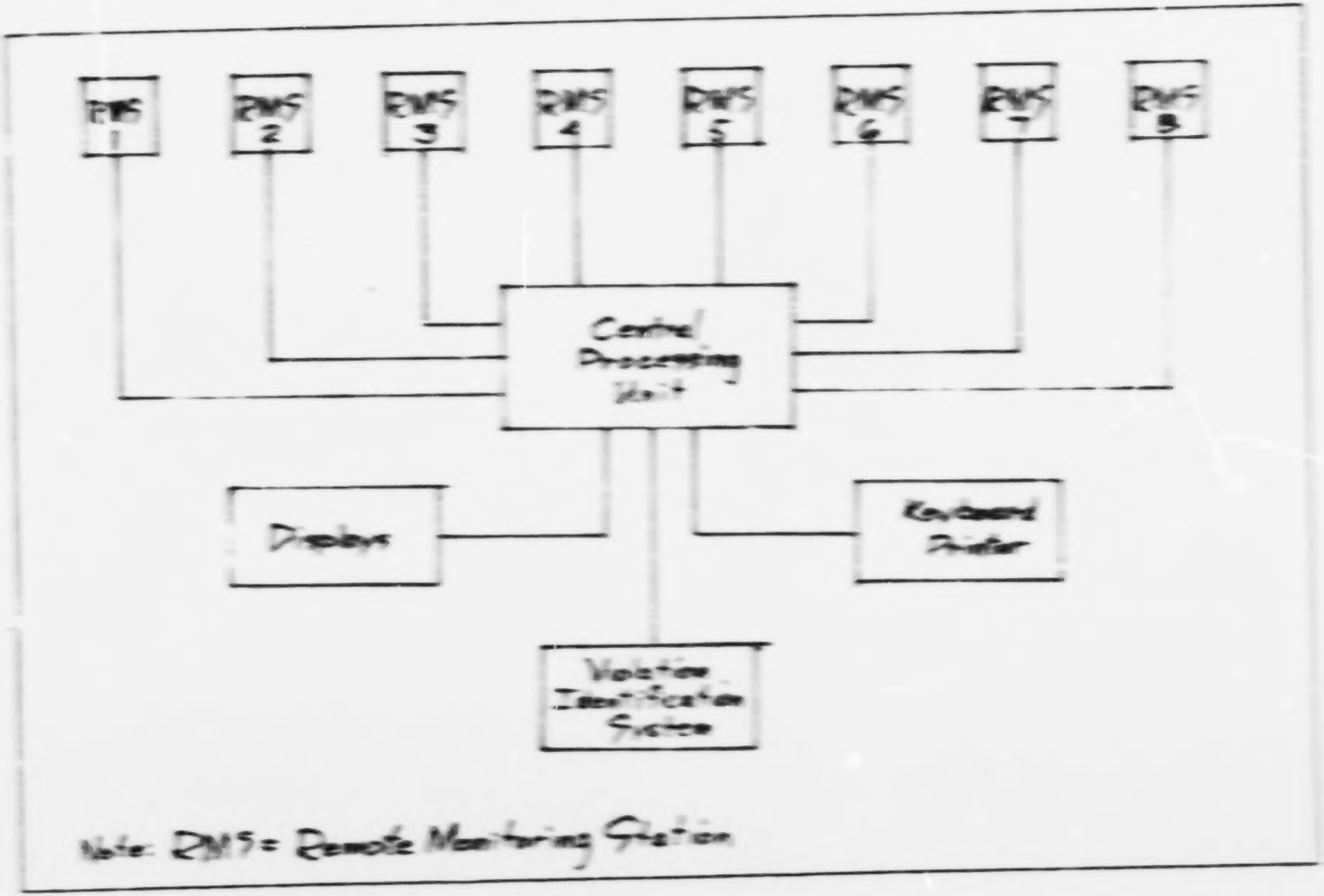


FIGURE 1 - [illegible]

REMOTE SITE BLOCK DIAGRAM



OVERALL SYSTEM BLOCK DIAGRAM


RMS 1
RMS 2
RMS 3
RMS 4
RMS 5
RMS 6
RMS 7
RMS 8
Central Processing Unit
Displays
Keyboard Printer
Violation Identification System

Note: RMS = Remote Monitoring Station

2.9 GENERAL RADIO

General Radio

Reference: EPA Contract
WA74-R326

July 19, 1974

Mrs. Carole S. Tanner
Project Engineer
Hydrospace-Challenger, Inc.
1360 Rosecrans Street
San Diego, California 92106

Dear Mrs. Tanner:

Many General Radio instruments have been used to measure aircraft noise, but not in the form of permanently installed, complete airport noise monitoring systems as described for the San Diego Airport in your enclosure.

We are enclosing a catalog of all GR noise measuring instruments plus some literature on specific products.

The GR Type 1921 Real-Time Analyzer System with a computer can measure EPNL, PNL, and PNLT.

We have produced a special version of the Type 1944 Noise Dosimeter for the FAA that measures time that noise has exceeded a certain threshold.

The Type 1523 Graphic Level Recorder plus the 1523-P1 Plug-in can be used for measuring dBA vs. time for an aircraft flyover.

Please let us know if you need any more specific information or details on any of our products.

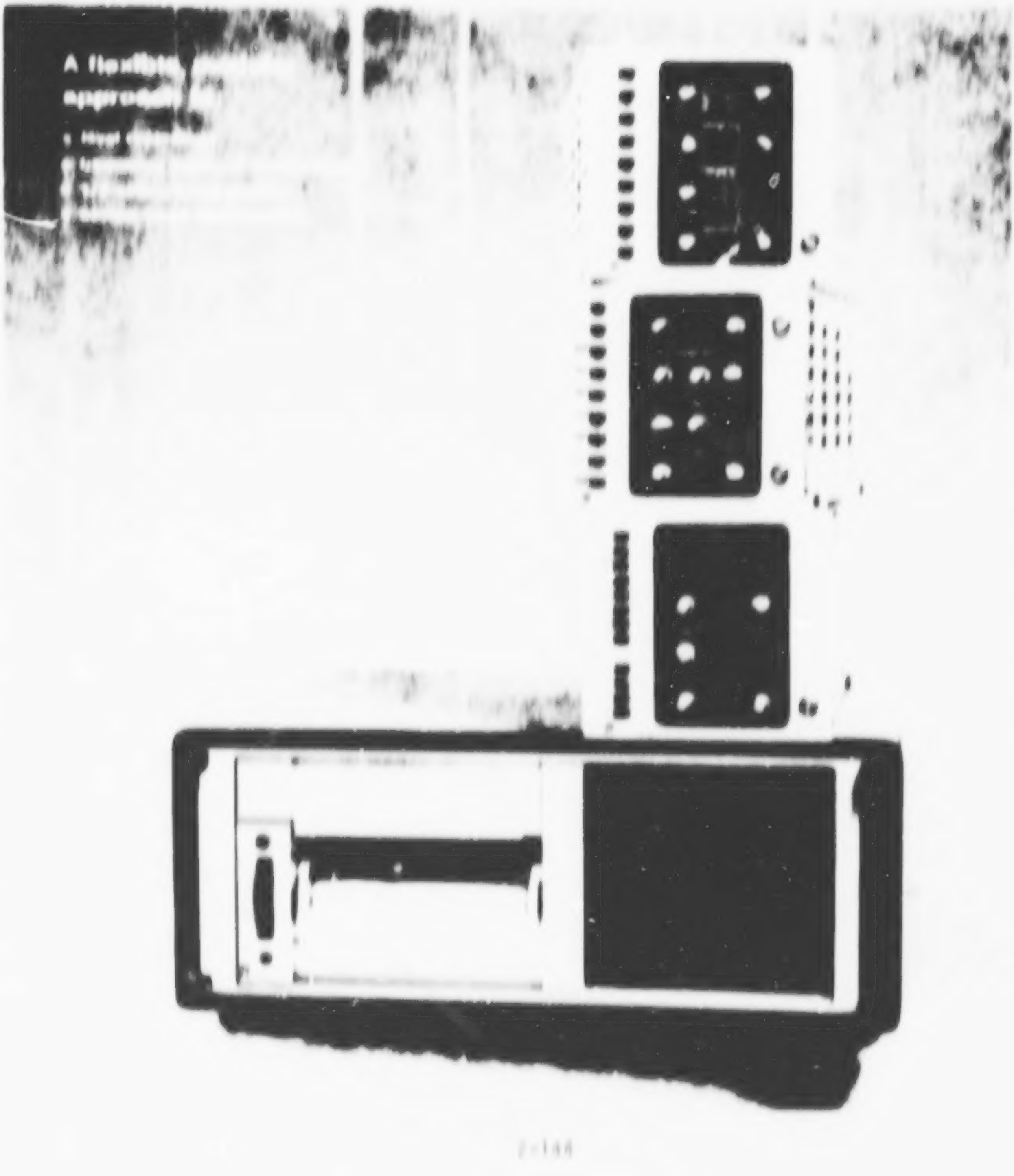
Very truly yours,

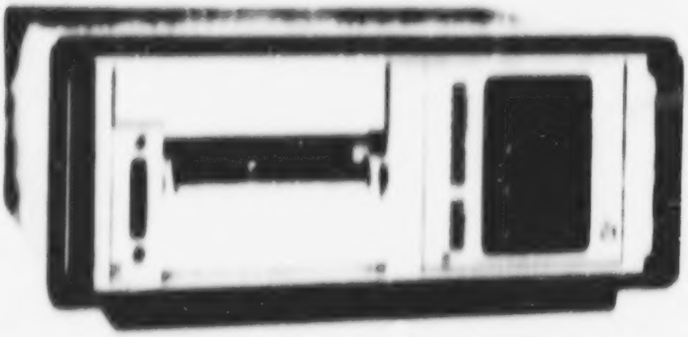
John E. Brook
Marketing Manager
Acoustics/Signal Analysis

JEB:VLB
Enc.

General Radio

GRAPHIC MEASUREMENT CENTER


A flexible
approach



1523 Graphic Level Recorder

- 1 Hz to 500 kHz frequency range
- 100 μV sensitivity
- up to 100 dB dynamic range
- up to 0.1 dB linearity
- 4 recorders in one with plug in versatility
- remotely programmable — a systems natural

Automatic measurements – simply and graphically The 1523 is not just another recorder. It is a measurement center. It incorporates the latest refinements of the recorder field with those of the [illegible] analyzer fields and does so in one instrument that eliminates the usual bother of trying to keep everything synchronized. Simply connect your signal or device, set up the desired measurement conditions, and push a button — the 1523 does the rest, automatically, and without constant attention or operator manipulation.

Narrow band wave analysis for

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]

[illegible]

Precise 1/3 octave band analysis for

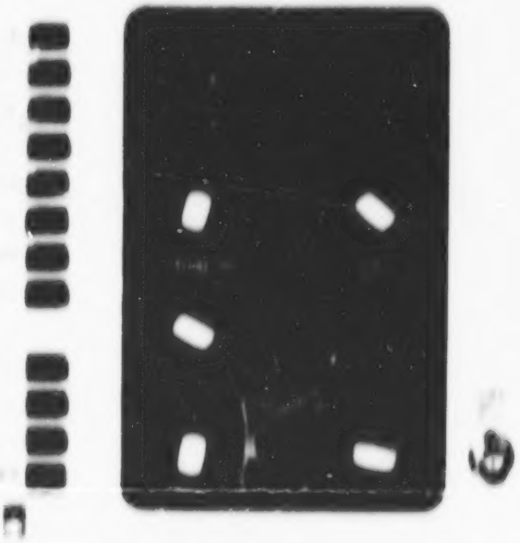
- [illegible]
- [illegible]
- [illegible]

[illegible]

Simple response measurements for

- [illegible]
- [illegible]
- [illegible]
- [illegible]

[illegible]



GR 1523-P1A Preamplifier Plug-in

- for level vs time recordings
- for A weighted level vs time recordings
- 1 MΩ input impedance
- 18 chart speeds

SPECIFICATIONS

Input [illegible]

Input Frequency [illegible]

Pen [illegible]

Recording [illegible]

Remote Control [illegible]

Remote Control [illegible]

1523-P1A Preamplifier Plug-in 1523-9600 $795.00

General Radio

GR 1523-P5 DC Preamplifier Plug-in

dc recording capability for the 1921 Real Time Analyzer

- **Automatic plotting of real time analysis data**
- **Automatic spectrum overlay capability**
- **Easy to use**

The 1523-P5 DC Preamplifier is a plug-in accessory for GR's 1523 Graphic Level Recorder. It is specifically designed to provide plots of spectra measured with the GR 1921 Real Time Analyzer.

The instrument simplifies and automates plotting of spectra analyzed by the 1921. Frequency is registered by the absolute time [illegible] number of [illegible] on the 1523. Logic circuits in the plug-in permit synchronized, automatic plotting, controlled from the 1921 Real Time Analyzer panel. Thirty 1/3-octave bands are plotted in less than 30 seconds.

It is often desirable to make more than one recording on the same chart to compare the effects of changes on the system being tested. This is accomplished by a "repeat chart" mode which rewinds the chart for repeating recordings after the completion of a plot. Readily interchangeable pens, available in red, green, and blue, can be used to distinguish each successive spectrum.

The 1523 mainframe for the 1523-P5 lets you add the following capabilities at any time through the use of other plug-ins:

- Level versus time plots (1523-P1A)
- Frequency response measurements (1523-P2)
- 1/3-oct band analysis (1523-P3)
- Wave analysis (1523-P4)

SPECIFICATIONS

Input: [illegible]

[illegible]

Recording: [illegible]

[illegible]

Speed: [illegible]

Control: [illegible]

Description	Catalog Number	Price
1523-P5 DC Preamplifier Plug-in	1523-9607	2850.00
Accessories required:		
[illegible]		
[illegible]	1523-9625	210.00
[illegible]	1523-9690	60.00

[illegible]

[illegible]

General Radio

[illegible]

can be made in the constant Q mode in ½ to ⅓ the time normally required.

The accuracy and stability of the generator, plus the resolution of the recorder and the variety of chart speeds and averaging-time programs, permit precise response measurements of almost any device — performed with the ease and economy of a single instrument rather than with the clutter and confusion of two.

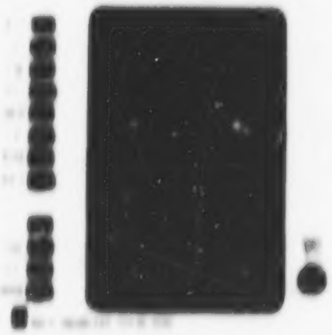
Versatile level recording for
- reverberation-time measurements
- general level-recording applications

Select the 1523-P1 Preamplifier plug-in for the best in general recorder performance. The 1523-P1 gives you a broad frequency coverage from 1 Hz to 500 kHz, a sensitivity of 100 µV, and 18 chart speeds from as slow as 20 hours per inch to as fast as half a second per inch. Continuously adjustable attenuation from 0 to 70 dB provides the utmost in recording resolution, and a choice of nine averaging times from 10 ms to 8 s allows supreme flexibility.

Conveniences standard. All plug-ins feature remote programmability, a variety of inputs and outputs to synchronize recorder operation with that of other instruments, and a choice of several potentiometers with dynamic ranges from 10 dB to 100 dB to tailor the instrument to your specific requirement.

For convenience, a chart take-up reel is included but the paper also can be fed out directly for immediate inspection and use. For interpretation, an event marker can be recorded by the simple push of a button at the desired time. For reliability, a stepper motor drives the chart (there are no gears or clutches to wear out, slip, or bind), and clog-free disposable pens eliminate messy refilling and provide clear, easily read, and skip-free traces even at the fastest writing speeds. You have a choice of colors and a choice of marker types: the Fastrak® Marker for general purposes and the Slow-Speed Marker for particularly slow-moving records or those with much retracing over a part of the chart. GO/NO-GO limit adjustments are included to provide LO, GO, and HI electrical outputs for external alarm or control applications.

SPECIFICATIONS



with 1523-P1 Preamplifier Plug-in

for level vs time recordings

- frequencies to 500 kHz • 100 µV sensitivity
- up to 100 dB dynamic range
- 1 MΩ input impedance • 18 chart speeds

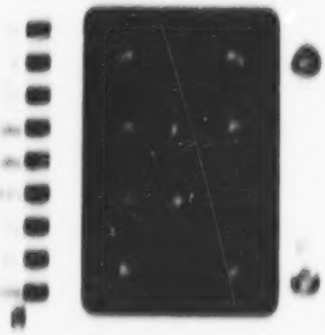
Input: [illegible] 0 dB (100 µV) to 70 dB [illegible] 10-dB steps [illegible] Sensitivity under 1523 Mainframe specifications. MAXIMUM INPUT: [illegible] IMPEDANCE: 1 MΩ [illegible] CONNECTORS: [illegible] Preamplifier.

Input Frequency: 1 Hz to 100 kHz [illegible] 500 kHz [illegible] 100 kHz [illegible]

Recording: CHART SPEED: [illegible] AVERAGING TIMES: 10 ms to 8 s [illegible]

[illegible] low-frequency cutoff [illegible] 1 dB down [illegible] 20 dB [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	2 Hz	8 Hz
[illegible]	[illegible]	[illegible]	[illegible]	1 Hz	3.5 Hz
[illegible]	[illegible]	[illegible]	[illegible]	1 Hz	1.6 Hz
[illegible]	[illegible]	[illegible]	[illegible]	1 Hz	1 Hz
[illegible]	[illegible]	[illegible]			



with 1523-P2 Sweep Oscillator Plug-in

contains sweep generator for level vs frequency recordings

- frequencies to 500 kHz • 100 µV sensitivity
- up to 100 dB dynamic range • 1 MΩ input impedance

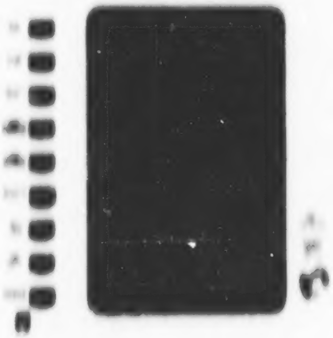
Input: [illegible] 0 dB (100 µV) to 70 dB [illegible] Sensitivity under 1523 Mainframe specifications. MAXIMUM INPUT: [illegible] IMPEDANCE: 1 MΩ [illegible] potentiometer via internal switch. CONNECTORS: Front and rear BNC and rear 3-pin A3 mike connector that also provides power for 1560-P40 or -P42 Preamplifier.

Input Frequency: 1 Hz to 500 kHz; flat within ±0.1 dB to 100 kHz, within ±2 dB to 500 kHz except on 0-dB range, down <3 dB at 100 kHz. Averaging times programmed automatically to avoid low-frequency cutoff; program can be inhibited by external input.

Recording: CHART SPEED: Automatically set by sweep time (see below) and decade length. Decade length can be set for 2, 2.5, 3, 4, 5 or 10 in./decade.

Sweep Frequency: 1 Hz to 500 kHz, automatically from lower to upper frequency. Lower frequency can be set to 1, 2, 5, 10, 20, 50, 100, or 200 Hz, 1, 10, or 100 kHz; upper frequency can be set to 10 or 100 Hz, 1, 2, 5, 10, 50, 100, 200, or 500 kHz. ACCURACY: ±1% of indicated frequency. STABILITY: ±0.05% over 10 min, ±0.25% over 24 h, after 30-min warmup. SWEEP TIME: 5 s to 200 ks/decade in 5, 10, 20 sequence, or manual sweep. Averaging time decreases with frequency as follows: 2 s from 1 to 10 Hz, 200 ms from 10 to 100 Hz, 50 ms from 100 Hz to 100 kHz, and 20 ms from 100 to 500 kHz. SWEEP RESOLUTION: 3000 discrete logarithmically scaled steps per decade (0.08% steps). SWEEP VOLTAGE: Dc output proportional to log of swept frequency available at rear connector.

Sweep Amplitude: 500 µV to 5 V rms into open circuit behind 600 Ω, ≥10 mW into 600 Ω, available at front BNC connector; set in four decade ranges of 5 mV to 5 V full-scale open circuit, plus continuous vernier; flat within ±0.1 dB to 100 kHz, within ±1 dB to 500 kHz. DISTORTION: <0.5% from 1 Hz to 100 kHz with any linear load. HUM: <0.01%. SPURIOUS (discrete nonharmonic): <-50 dB. NOISE: <-80 dB re full scale in 100 kHz bandwidth.



with 1523-P3 Stepped 1/3 Octave Band Analyzer Plug-in

contains 1/3 octave band filters for spectrum recording

- 1 Hz to 80 kHz • 50 1/3-octave bands
- 100 µV sensitivity • 1 MΩ input impedance
- averaging times varied automatically for true constant-confidence results

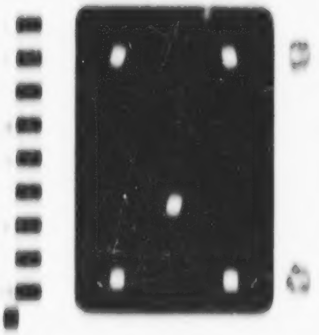
Input: [illegible] 10 dB steps plus [illegible]. MAXIMUM INPUT: ±10 V pk ac to 100 kHz, ie dc component of ±80 V max. IMPEDANCE: 1 MΩ/30 pF at plug-in; 3.35 kΩ ±1% direct to potentiometer via internal switch. CONNECTORS: Front and rear BNC and rear 3-pin A3 mike connector that also provides power for 1560-P40 or -P42 Preamplifier.

Input Frequency: 1 Hz to 80 kHz center frequencies; fifty 1/3-octave noise-bandwidth (bands 0 thru 49) 3-pole Butterworth filters with Class II (moderate attenuation) Type D characteristics that conform to ANSI S1.11-1966 for sound-level recordings; switch-selected flat response (all pass) channel at start of chart displays overall level. Also available with filter characteristics conforming to IEC 225, as Type 1523-P3I. CENTER-FREQUENCY ACCURACY: ±3%. LEVEL UNIFORMITY: ±1 dB at center frequencies. PASSBAND RIPPLE: 1 dB pk-pk max. NOISE: Equivalent input noise below 0 dB (re 100 µV) for all-pass, and bands 0-39, increasing 1 dB/band to below 10 dB in band 49. HARMONIC DISTORTION: <0.1% for signals of 1 V rms at band centers. STOP-BAND ATTENUATION: >60 dB for frequencies of <0.8 and >1.8 times center frequency. OUTPUT: Filtered input signal available at rear connector. PEAK MONITOR: Included with panel lamp to indicate overload.

Input Frequency Scan: Adjustable; automatically steps from lower frequency to (but not from) upper frequency. Lower center frequency can be set to 1, 2, 10, 20, 100, or 1000 Hz; upper center frequency can be set to 0.1, 1, 2, 10, 20, or 100 kHz.

Analysis Programs: SET OF PROGRAMS: 11, designated A, B, C, [illegible]. VARIETY: Program A provides constant averaging time per band; others, combinations of the same with a series of steps of constant-confidence averaging time [illegible]. CONFIDENCE: [illegible]

stop frequencies each set by 4 [illegible] **BANDWIDTH:** 10 Hz, 100 Hz and [illegible] **PASS BAND SHAPES** [illegible] 60 dB bandwidth [illegible] 80 dB bandwidth [illegible] **ACCURACY OF RECORDED FREQUENCY** [illegible] **STABILITY** [illegible] **DISTORTION** [illegible] **NOISE** [illegible] **IMAGE REJECTION** [illegible] **REJECTION** [illegible]



With 1523 P4 Wave Analyzer Plug-in
for detailed noise and vibration analysis

- 80 dB dynamic range
- 10 Hz and 100 Hz bandwidths
- Tracking output
- 10 Hz to 80 kHz analysis range
- Linear and log frequency displays

Main Input: [illegible] **TOTAL MEASUREMENT RANGE** [illegible] **DYNAMIC RANGE** [illegible] **MAXIMUM INPUT** [illegible] **INPUT OVERLOAD** [illegible] **CONNECTORS** [illegible] **ACCURACY** [illegible]

Analyzer Characteristics: **FREQUENCY** [illegible] **SWEEP RANGE** [illegible]

Analysis Modes: **AUTOMATIC** [illegible]

Secondary Inputs: [illegible]

Tracking Output: **FREQUENCY** [illegible]

Other Outputs: [illegible] **RETRANSMITTING** [illegible] **SWEEP** [illegible] **DIGITAL** [illegible]

MAINFRAME SPECIFICATIONS

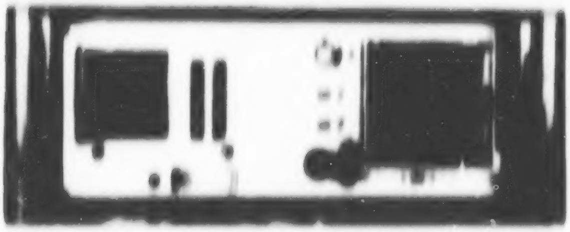
Dynamic Range: Up to 100 dB [illegible] **POTENTIOMETERS** [illegible] **MAXIMUM INPUT SENSITIVITY** [illegible] **DEAD BAND** [illegible] **NOISE** [illegible] **TRANSMITTING POTENTIOMETER** [illegible]

Pen Control: [illegible]

Chart Control: [illegible]

[illegible]

Limits and Event Markers: **LIMITS** [illegible] **EVENT MARKERS** [illegible]



Interface: [illegible]

Supplied: [illegible]

Event Marker Set [illegible] 4 red and 4 black pens, 3 potentiometer contacts, 2 paper cap assemblies, 50 chart mounting sheets, power cord, double 19-pin etched-board connectors (1 or 2) for external programming (inputs and outputs) with each plug-in.

Power: 100 to 125 or 200 to 250 V, 50 to 60 Hz, 90 W typical, 160 W max.

Mechanical: Bench or rack models. DIMENSIONS [illegible] Bench 19.56×8.44×19.63 in. (496×214×498 [illegible]) [illegible] 19× 7×19.69 in. (483×178×500 mm). WEIGHT: [illegible] [illegible] plug-in: 63 lb (29 kg) net, 98 lb (45 kg) shipping [illegible] [illegible] cluding plug-in: 57 lb (26 kg) net, 92 lb (42 kg) [illegible] pping; plug-in when shipped separately: 8 lb (3.7 kg) [illegible] 16 lb (8 kg) shipping.

Description	Catalog Number	Price
1523 Graphic Level Recorder		
[illegible]		
Bench Model	1523-9[illegible]	$[illegible]
Rack Model	1523-9[illegible]	[illegible]
Select at least 1 of following plug-ins [illegible]		
[illegible] Plug-in [illegible]	1523-[illegible]	[illegible]
Sweep Oscillator Plug-in [illegible]	1523-[illegible]	[illegible]
Stepped [illegible] Octave-Band Analyzer Plug-in [illegible]	1523-9[illegible]	[illegible]
Stepped 1/3-Octave-Band Analyzer Plug-in [illegible]	1523-[illegible]	[illegible]
Wave Analyzer Plug-in [illegible]	1523-[illegible]	[illegible]
Select at least 1 of following potentiometers [illegible]		
10-dB Potentiometer	1523-[illegible]	[illegible]
25-dB Potentiometer	1523-[illegible]	[illegible]
50-dB Potentiometer [illegible]	1523-[illegible]	[illegible]
[illegible]-dB Potentiometer [illegible]	1523-[illegible]	[illegible]
[illegible]-dB Potentiometer	1523-[illegible]	[illegible]
Accessories available		
Event Marker Sets, 4 black and 4 red pens	1522-9617	10.25
Mounting Sheets [illegible]	1522-9[illegible]	[illegible]
[illegible] Marker Sets [illegible]		
Set of 4 RED pens	1522-9[illegible]	[illegible]
Set of 4 [illegible] pens	1522-9[illegible]	[illegible]
Set of 4 BLUE pens	1522-9[illegible]	[illegible]

Description	Catalog Number	Price
[illegible] Marker Sets		
Set of 4 RED pens	[illegible]	[illegible]
Set of 4 [illegible] pens	[illegible]	[illegible]
Set of 4 BLUE pens	[illegible]	[illegible]
[illegible]		
Chart Paper [illegible]		
FOR 1523-P1 PREAMPLIFIER [illegible]	[illegible]	[illegible]
FOR 1523-P2 SWEEP OSCILLATOR [illegible]	[illegible]	[illegible]
[illegible]	1523-[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
FOR 1523-P3 STEPPED [illegible] BAND ANALYZER [illegible]	1523-[illegible]	[illegible]
FOR 1523-P4 WAVE ANALYZER [illegible]	1523-[illegible]	[illegible]

[illegible] potentiometer.

Quantity Discount The following quantity discounts apply to identical units and packages purchased on a single order, normally for single shipment to one destination. All items in this pamphlet are subject to these discounts.

Quantity	1 to 9	10 to 19	20 to 49	50 to 99	100
Discount	net	10%	[illegible]	[illegible]	20%

Prices effective March 18, 1973, net F.O.B. Concord, Massachusetts 01742, U.S.A., subject to change without notice. Source Inspection Surcharge 1% [illegible] $5.00 per shipment. Minimum billing $10.00 except for repair parts and cash with order transactions.

General Radio [illegible]

NEW YORK
[illegible]

BOSTON
[illegible]

WASHINGTON D.C.
[illegible]

ATLANTA
[illegible]

DAYTON
[illegible]

CHICAGO
[illegible]

DALLAS
[illegible]

LOS ANGELES
[illegible]

SAN FRANCISCO
[illegible]

CANADA
General Radio Canada Limited
[illegible]

EUROPE, AFRICA and NEAR EAST
General Radio Company (Overseas)
[illegible]

ASIA, PACIFIC and LATIN AMERICA
General Radio International Division
Concord, MA 01742
[illegible]

GR COMPANIES • [illegible] • GR ASSOCIATE • [illegible]

APPLICATIONS FOR REALTIME ANALYSIS

PRODUCT DESIGN [illegible]

[illegible]

[illegible]

COMPLIANCE WITH REGULATIONS [illegible]

[illegible]

SPECIAL TECHNICAL APPLICATIONS [illegible]

[illegible]

[illegible]

[illegible]

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WHAT IS A REALTIME ANALYZER?

[illegible]

[illegible] 20 kHz frequency [illegible]

[illegible]

[illegible] many times faster than [illegible] a serial analyzer. The figure below illustrates this approach.

The data analyzed by a real-time analyzer [illegible] very quickly. [illegible] output provides a pictorial picture of the spectrum and quantitative data [illegible] the digital display or one of many [illegible] peripheral output devices such as dc recorders and printers.

WHY USE A REALTIME ANALYZER?

[illegible]

[illegible] and other mechanical devices.

[illegible] process the signal [illegible] to provide [illegible] spectra [illegible] a short period of time.

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THE GR APPROACH

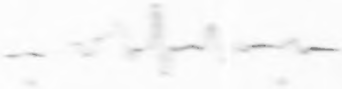
[illegible]

WHY USE DIGITAL DETECTION?

[illegible]

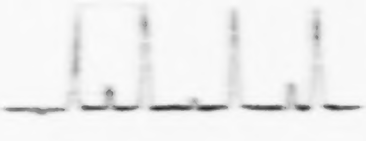
[illegible] RANGE — [illegible]

SELECTABLE, PRECISELY CONTROLLED INTEGRATION TIME — [illegible]



[illegible]

HIGH CREST-FACTOR CAPACITY — The [illegible]



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ANOTHER IMPORTANT FEATURE

The 1921 is the only real-time analyzer with adjustable filter attenuation. The attenuation can be adjusted to equalize the entire measurement system for flat or specially shaped response. Applications are [illegible] out the record/playback response of a tape recording or extending the dynamic range of the instrument by weighting a portion of the spectrum.

The filter section of the analyzer also provides a summed output, which is the weighted, recombined input signal after it has passed through the adjustable attenuators and filters. By listening to the output on headphones and adjusting the attenuators, you can simulate changes in the product being tested and assess the subjective acoustic value of making such changes. This technique greatly minimizes cut and try methods.

THE 1921 IS EASY TO USE

A MEASUREMENT CAN BE MADE IN JUST A FEW STEPS:

1. SELECT THE DESIRED INTEGRATION TIME.
2. PRESS THE START BUTTON TO BEGIN THE MEASUREMENT.
3. OBSERVE THE SPECTRUM ON THE OSCILLOSCOPE DISPLAY, ONE BAND AT A TIME ON THE BUILT-IN DIGITAL DISPLAY, OR ON ONE OF THE MANY OTHER OUTPUT DEVICES AVAILABLE.

[illegible]

3. 1921-P2 STORAGE DISPLAY UNIT (OPTIONAL)

OUTPUT SPECTRUM

CONTROL CHANNEL RMS DETECTOR

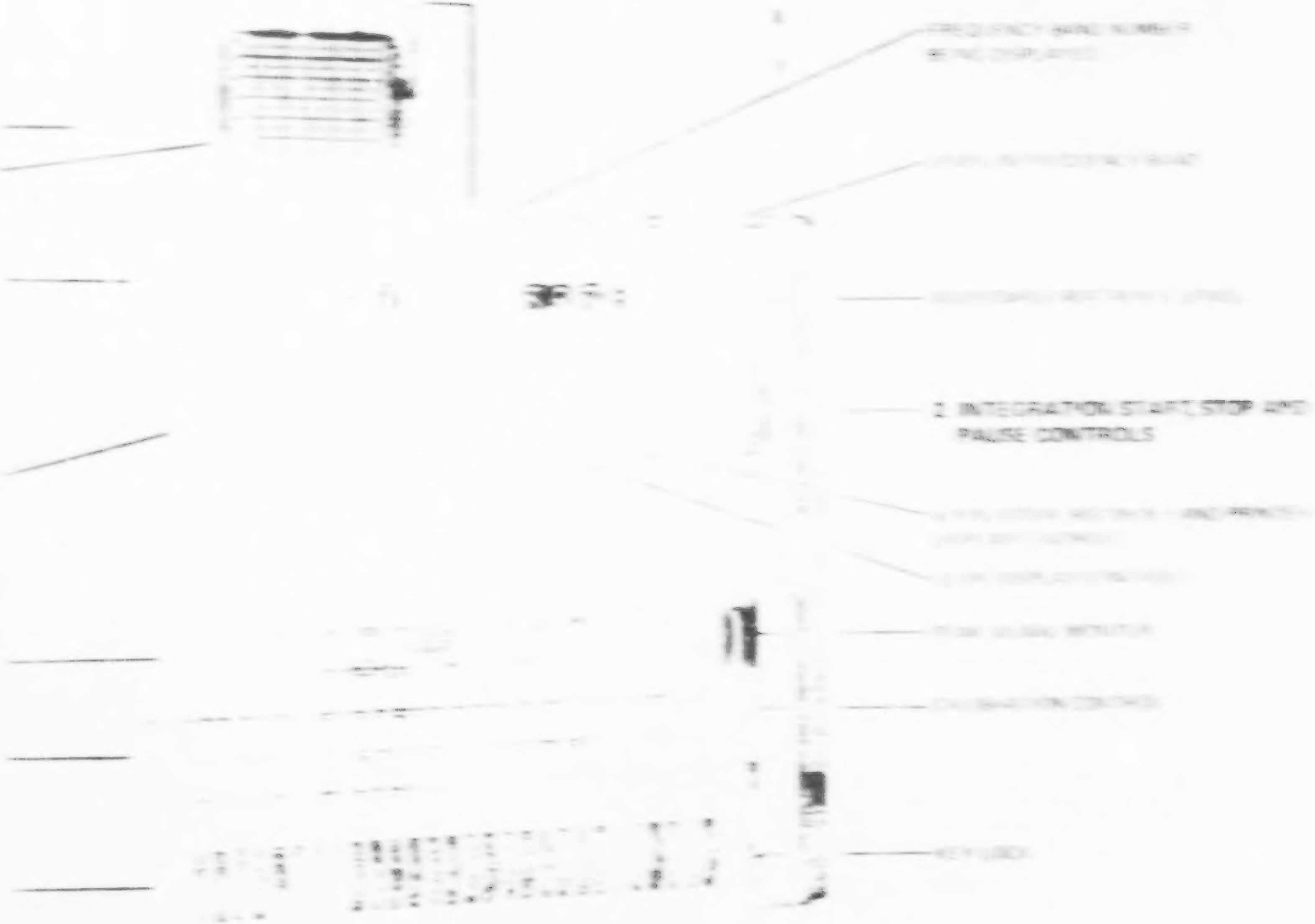
1. SELECTION OF INTEGRATION TIME (FROM 1/8 TO 32 SECONDS)

INDICATION OF ATTENUATOR SETTING

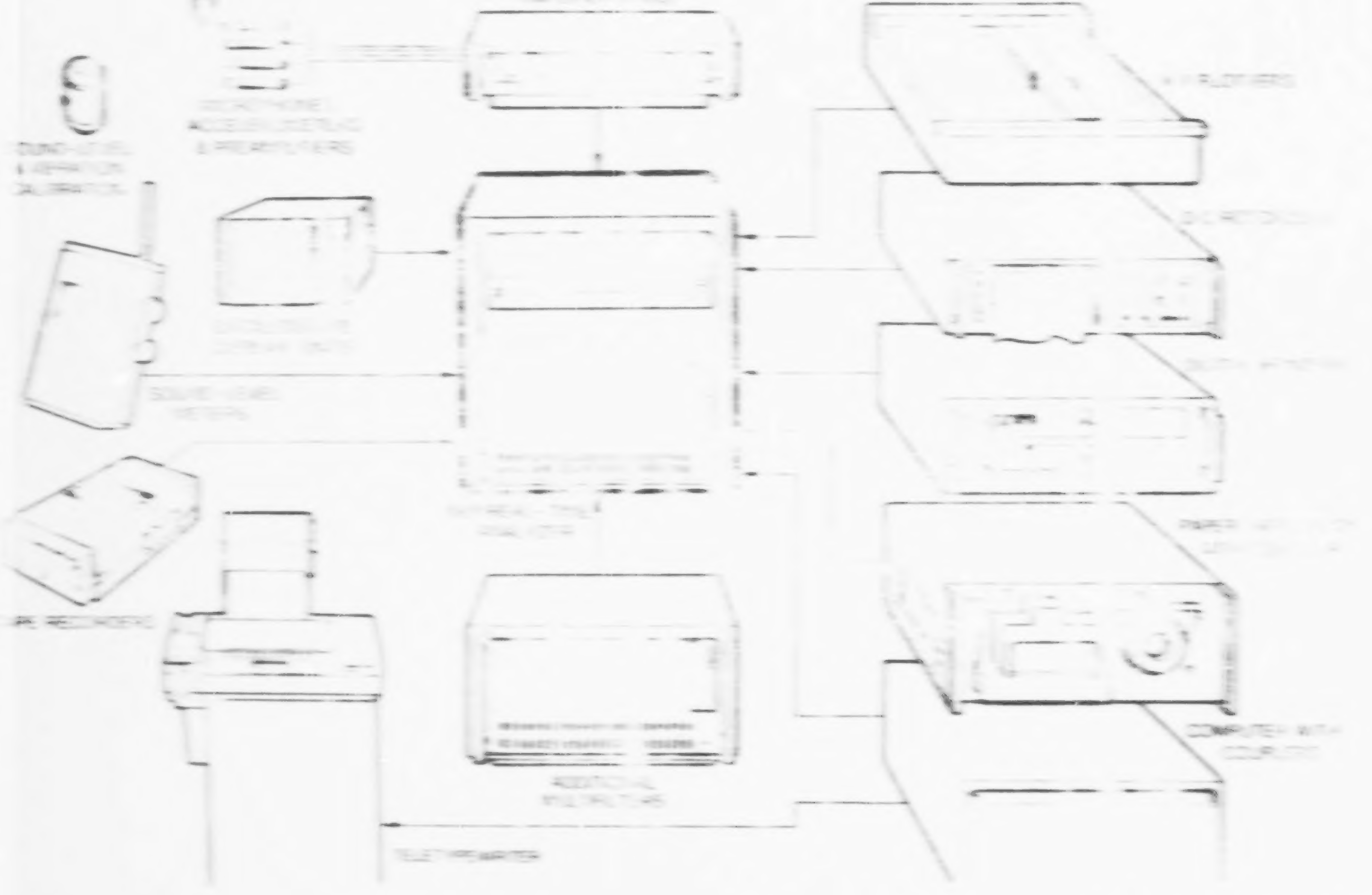
1925 MULTIFILTER

ATTENUATOR ADJUSTMENT

[illegible]


FREQUENCY BAND NUMBER BEING DISPLAYED
DISPLAY FREQUENCY BAND
[illegible]
2. INTEGRATION START, STOP AND PAUSE CONTROLS
[illegible] AND PRINTER DISPLAY CONTROLS
[illegible] DISPLAY CONTROLS
PEAK SIGNAL INDICATOR
CALIBRATION CONTROL
KEY LOCK

PERIPHERAL EQUIPMENT FOR THE 1921


SOUND LEVEL & VIBRATION CALIBRATOR
MICROPHONES, ACCELEROMETERS & PREAMPLIFIERS
SOUND LEVEL METERS
TAPE RECORDERS
X-Y PLOTTERS
COMPUTER WITH CONSOLE
TELETYPEWRITER

PERIPHERAL EQUIPMENT

[illegible]

B. DIGITAL OUTPUT DEVICES

[illegible]

Paper Tape Punch/Reader. [illegible]

Computer Interface. [illegible]

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CUSTOM REALTIME ANALYSIS SYSTEMS

[illegible]

[illegible]

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SPECIFICATIONS

[illegible]

2.10 HEWLETT-PACKARD PALO ALTO

HEWLETT PACKARD

[illegible]

July 19, 1974

Hydrospace-Challenger, Inc.
1360 Rosecrans Street
San Diego, CA 92106

Attn: Mrs. Carole B. Tanner
Project Engineer

Subject: Your letter of July 10, 1974

Dear Mrs. Tanner:

Thank you for your letter and your interest in our systems related to airport noise monitoring.

I am sorry to tell you that Hewlett-Packard is no longer active in this instrumentation area. We did make a number of overseas installations; the most comprehensive being the one at the Stuttgart Airport in West Germany. However, since this was installed perhaps five or six years ago, I doubt seriously that it represents the most modern in technology. On the other hand, operating experience gained at the Stuttgart Airport might be of considerable value in your work. I presume that you would be able to contact that organization directly, and I am sure that they would be able to give you a more comprehensive report than we could.

I am sorry we can't be more helpful. If, however, you have some specific questions that you would like us to answer, I suggest that you call me here in Palo Alto at (415) 493-1501, Ext. 2696.

Very truly yours,

HEWLETT-PACKARD COMPANY

Robert H. Brunner
Group Marketing Mgr. - International

[illegible]

2.11 THE PORT AUTHORITY OF NEW YORK AND NEW JERSEY

THE PORT AUTHORITY OF NY & NJ

One World Trade Center
New York, N.Y. 10048

Aviation Department
[illegible], Director

[illegible], Deputy Director

Louis Achitoff, Chief Aviation
Technical Services Division
(212) 466-7472
(201) 622-6600 x7472

July 19, 1976

Mrs. Carole S. Tanner
Project Engineer
EO&G
Hydrospace-Challenger, Inc.
1360 Rosecrans Street
San Diego, California 92106

Dear Mrs. Tanner:

Your letters of July 10, 1976 to the Airport Managers of Newark International and LaGuardia Airports have been referred to this office for reply.

We are aware that the EPA intends to propose to the FAA that an Airport Noise Regulation be promulgated. We have not yet, however, seen the draft proposal, the substance of which will determine the types of, and extent to which monitoring systems will be a factor in its application.

Under the circumstances, therefore, we intend to await the EPA proposed regulation before submitting the information you requested.

Very truly yours,

Louis Achitoff

Louis Achitoff, Chief
Aviation Technical Services Division

[illegible]

LA:ch

THE PORT AUTHORITY OF NY & NJ

John F. Kennedy International Airport

July 23, 1975

Mrs. Carole Tanner, Project Engineer
Hydrospace-Challenger, Inc.
1360 Rosecrans Street
San Diego, California 92106

Dear Mrs. Tanner:

In view of the decision of our Director of Aviation to await the EPA draft Airport Noise Regulation before providing data on noise monitoring at Kennedy International Airport, the information I described in my letter of July 19th, will, of necessity, be delayed.

I regret if I have caused you any inconvenience.

Very truly yours,

Frank B. [illegible], Manager
Aeronautical Services Division
Kennedy International Airport

FBC:jc

THE PORT AUTHORITY OF NY & NJ

Aviation Department
[illegible]

[illegible]

John F. Kennedy International Airport
[illegible]

July 19, 1976

Mrs. Carole Tanner, Project Engineer
Hydrospace-Challenger, Inc.
1360 Rosecrans Street
San Diego, California 92106

Dear Mrs. Tanner:

This will acknowledge receipt of your request for information regarding noise monitoring at Kennedy Airport.

We are in the process of compiling the information, and we will make every effort to complete our report and have it available within the 30 day period you requested.

Very truly yours,

Frank B. Colley, Manager
Aeronautical Services Division
Kennedy International Airport

FBC:jc

2.12 STUTTGART AIRPORT, WEST GERMANY

Flughafen Stuttgart
GmbH

Hydrospace-Challenger, Inc.
[illegible] Rosecrans Street
SAN DIEGO
California [illegible]

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	20.07.83	[illegible]	[illegible]	15.08.1983

Re: Noise Monitoring System
Your letter 20.7.1983

Gentlemen,

Enclosed we return to you the [illegible] sent to us in July 1983 together with your enclosures.

[illegible]

Very truly yours
FLUGHAFEN STUTTGART GMBH

[illegible]

AIRPORT LOCATION AND PHYSICAL FEATURES

LOCATION Stuttgart, Baden Württemberg, West Germany	LATITUDE 48° 41' 19" N	LONGITUDE 9° 12' 39" E

ELEVATION 396 m	TERRAIN Plateau, surrounded by 495 m hills in West.

APPROACHES

Populated area

GENERAL LOCATION MAP see Fig. 4	TOTAL JET OPS appr 100/day	DATE INSTALLED April '79	FLIGHT TRACKING?
	DAY appr 90	THRESHOLD 08 ARR	
	EVE appr 8	VIOLATION HISTORY None	
	NIGHT 2		
	NIGHT RESTRICTIONS No jet aircraft 2200 - 0600		

INSTALLATION MAP

see Fig. 4

AIRPORT LOCATION AND PHYSICAL FEATURES, Cont'd

SYNOPSIS OF SYSTEM

7 Noise monitoring terminals
1 Central processing unit
2 Heavy duty teletype

For further information see Encl 2 + 3

NOTES

AIRPORT TYPICAL WEATHER CONDITIONS

WEATHER MEASUREMENTS AT AIRPORT Deutscher Wetterdienst Flugwetterwarte Stuttgart	TEMPERATURE 20+ °C HUMIDITY — WIND SW RAINFALL —

TEMPERATURE

RAIN

HUMIDITY

WIND

TOTAL SYSTEM PERFORMANCE

NOISE STANDARD, LAW, REGULATION GOVERNING SYSTEM DESIGN

Gesetz zum Schutz gegen Fluglärm; March 30, 1971

UNIT OF NOISE MEASUREMENT

dB (A)

RANGE AND RESOLUTION OF NOISE THRESHOLD SETTING

75 - 85 dB(A)

VIOLATION DETERMINATION

None

VIOLATION THRESHOLD RANGE AND RESOLUTION

None

VIOLATION LIMIT RANGE AND RESOLUTION

92 - 95 dB(A)

ON LINE/OFF LINE DATA AVAILABILITY

On line

PERCENT UTILIZATION OF SYSTEM

Continuous

TIME TO INSTALL OR ACTIVATE SITE

—

WEATHER REQUIREMENT AT SITE

All-weather operation

DATA USAGE

- ☒ LITIGATION INVOLVING NOISE LEVELS
- ☐ PHYSICAL ACOUSTICAL RESEARCH
- ☒ COMMUNITY RESPONSE
- ☒ AIRPORT PLANNING
- ☐ CERTIFICATION OF AIRCRAFT

DATA REVIEWED BY:

- ☒ AIRPORT OPERATOR
- ☒ CITY, COUNTY
- ☒ STATE
- ☐ FEDERAL
- ☐ ACOUSTICAL CONSULTANT
- ☐ ENVIRONMENTAL GROUPS
- ☐ AIRCRAFT OPERATORS

TOTAL SYSTEM ACCURACY

± 1 dB(A)

SYSTEM RESOLUTION

—

SYSTEM RANGE

50 - 120 dBA

SYSTEM OPTIONS/EXPANDABILITY

—

REMOTE SITES – ACOUSTIC SENSORS

TYPE Hewlett-Packard 15119C

NUMBER 8

INSTALLATION Pole-mounted, app. 8 m above obstructions

INSTALLATION FREQUENCY RESPONSE

see Encl. 2

LINEARITY

TEMP COEFFICIENT

PRESSURE COEFFICIENT

HUMIDITY COEFFICIENT

WINDSCREEN

BIRD PROTECTION

LIGHTNING PROTECTION

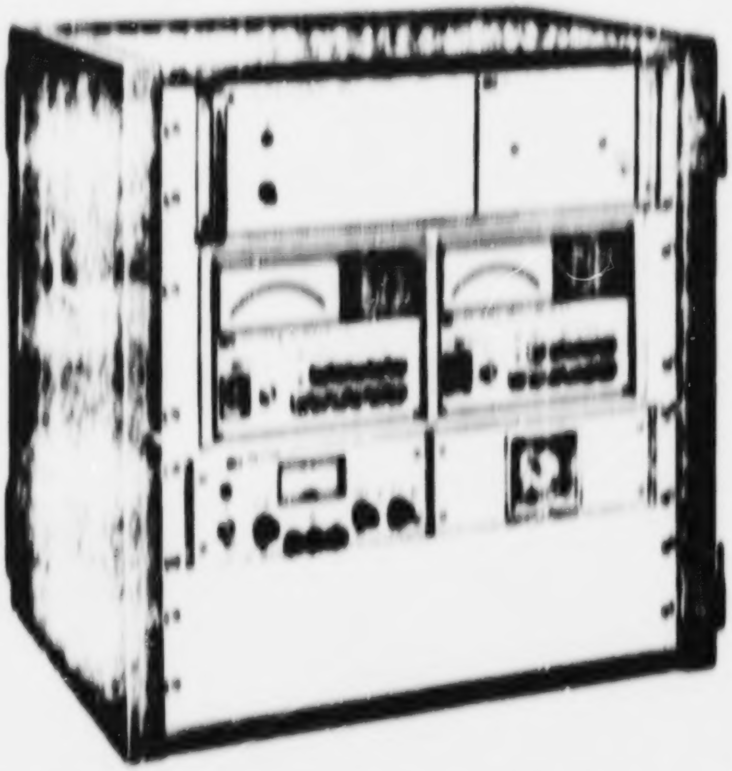
PREAMP GAIN

NOTES

MIN NOISE LEVEL OF MIC/PREAMP

PHOTO

see Encl 2



REMOTE SITES – EQUIPMENT

SIGNAL CONDITIONING

GAIN RANGES

GAIN SELECTION

DETECTION

RMS / LOG CONVERSION

MODEM

SAMPLE RATE	MESSAGE CONTENT

ACOUSTIC CALIBRATION

INSERT CALIBRATION

ACTUAL MONITORING

REMOTE CONTROLLABLE FUNCTIONS

SIZE	WEIGHT	TEMP RANGE
CONSTRUCTION	POWER REQUIREMENTS	TIME OF UNATTENDED OPERATION

COMMUNICATION

PHOTO	NOTES

see Encl. 2

TRANSMISSION LINK

TYPE
Normal telephone line

CHANNELS PER SITE
1

PATH LENGTHS
1 - 4 km

TRANSMISSION POWER LEVEL
—

FREQUENCY RESPONSE OF CHANNEL
300 - 3400 Hz

DYNAMIC RANGE
—

MODEM

MESSAGE RATE | BIT RATE

MESSAGE CONTENT

ERROR DETECTION

ERROR CORRECTION

MESSAGE FORMAT

see Encl. 2

CENTRAL DATA PROCESSING AND DISPLAY

TYPE OF PROCESSOR

Hewlett-Packard, Model HP 5170 A

SUBSYSTEMS AND EQUIPMENT CONFIGURATION

DISPLAYS, ALARMS, MONITORS

see Encl 2

NO. REMOTE SITES

PROVISION FOR NEW SITES

LOGS

CENTRAL PROCESSING SOFTWARE

NUMBER WORDS OF PROGRAM	NUMBER WORDS OF DATA
NUMBER WORDS SPARE	PEAK PERCENTAGE UTILIZATION OF COMPUTER
METHOD OF LOADING PROGRAM	PROVISIONS FOR ERROR MESSAGES
NUMBER OF OPERATOR INPUTS	

see Encl. 2

TRACKING

TYPE		
RANGE COVERAGE	RANGE ACCURACY	RANGE RATE
BEARING COVERAGE	BEARING ACCURACY	BEARING RATE
ALTITUDE COVERAGE	ALTITUDE ACCURACY	ALTITUDE RATE
NUMBER TRACKING SITES	LOCATION	
ACTIVE/PASSIVE TARGETS	TRANSPONDER OR BEACON	
ANALOG/DIGITAL RECORDING OF DATA	REAL TIME PLOT OF TARGET	PLOT SCALE
RECORDED DATA ACCURACY	OFF LINE PROCESSING TURNAROUND TIME	PLOT ACCURACY
PROCESSED PLOT OF TARGET	PROCESSED PLOT SCALE	PROCESSED ACCURACY
LINE PRINTER PARAMETERS LISTED		
RATE PARAMETERS ARE LISTED ON LINE PRINTER		
PHOTO	NOTES	

SYSTEM COST/SCHEDULE

DESIGN COST —	DESIGN MAN MONTHS —	DESIGN PERIOD 6 month
PROCUREMENT COST —	PROCUREMENT MAN MONTHS —	PROCUREMENT PERIOD —
SYSTEM COST INSTALLED 360.000,- DM	MANUFACTURE MAN MONTHS —	MANUFACTURE PERIOD 9 month

YEARLY MAINTENANCE COST > 100.000,- DM incl operating costs	RENTAL/LEASE COST PER YEAR —
OPERATIONS COST —	LIFE EXPECTANCY 15 years
CURRENT REPLACEMENT COST ?	

PERSONNEL REQUIREMENTS IN NUMBER PEOPLE AND MAN HOURS PER YEAR

MAINTENANCE } 1 MAN HOURS } 1.800
OPERATION MAN HOURS
DATA REVIEW MAN HOURS

CENTRAL PROCESSING UNIT BLOCK DIAGRAM

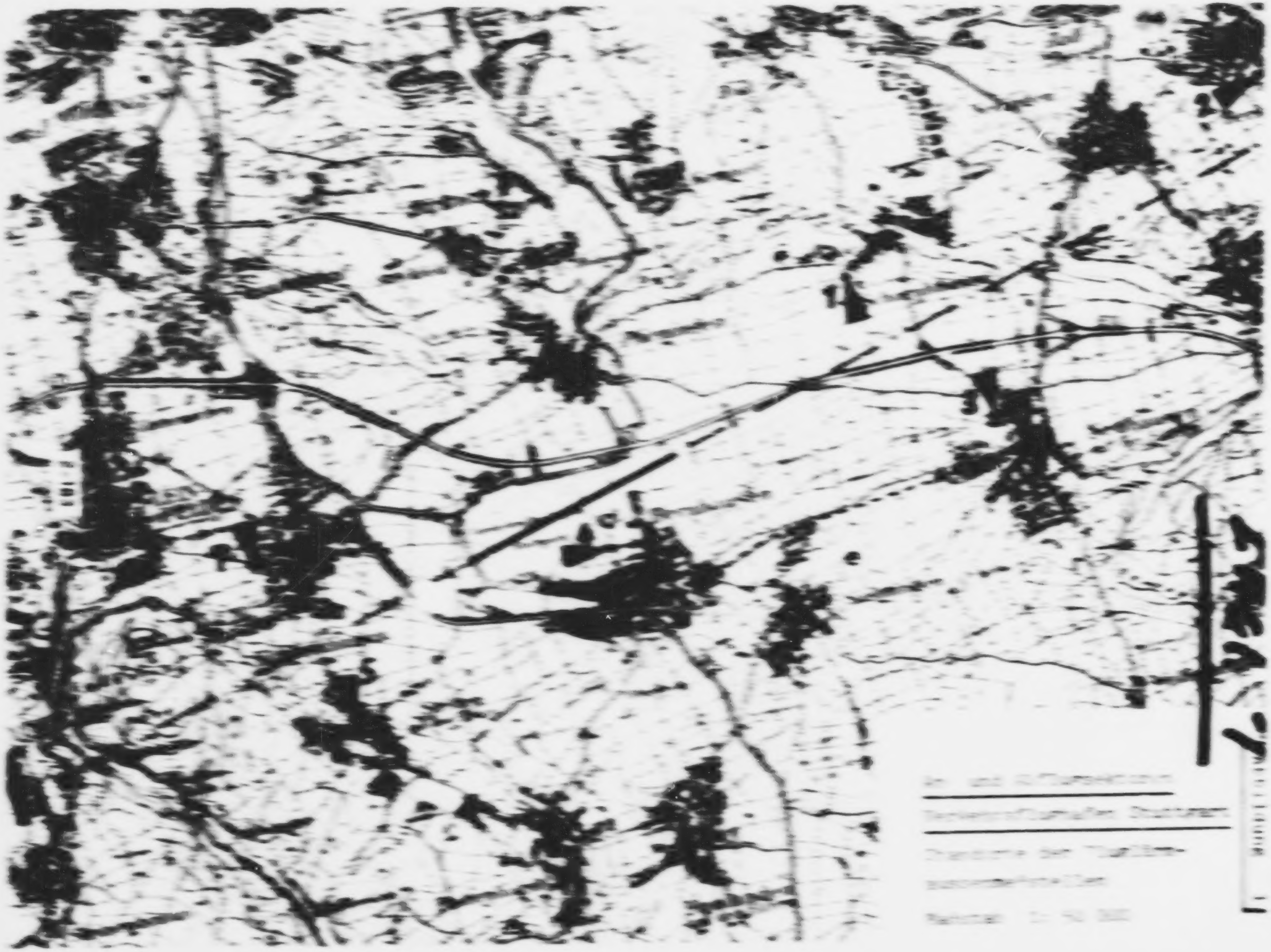
see Encl. 2.

REMOTE SITE BLOCK DIAGRAM

see Encl. 2

OVERALL SYSTEM BLOCK DIAGRAM

see Encl. 2.



Encl. 2

HEWLETT hp PACKARD

HEWLETT-PACKARD GMBH

aircraft noise monitoring system

model 80500 A

TECHNICAL DATA 4/71

expandable system

flexible processing procedures

fully automatic system for operation

unattended computation of
ready to use results

INTRODUCTION

The Hewlett-Packard [illegible] Aircraft Noise Monitoring System is designed to monitor the sound level at a number of locations in or around an airport and then immediately process the data at a central location to provide results in the optimal form for evaluation. The [illegible] system meets the requirements of ICAO recommendations 1/2, 1/3 and 1/4 as well as IEC recommendation 179. The obtained results can be used to determine effective methods of reducing the annoyance to neighbors of the airport and to detect deviations from preset flight routes or unusually low flying. The system can even identify evasive flight maneuvers which a pilot might perform to avoid detection at a Noise Monitoring Terminal. This brochure describes a system the kind of which has been installed on a number of major International Airports.

INSTANT INFORMATION

A most important advantage provided by the [illegible] system is that meaningful results are available while the offending aircraft is still in the vicinity of the airport. Corrective action, such as scheduling an inspection of the aircraft or instructing the pilot to alter his flying route or flying technique can be initiated at the time of violation.

EASY TO INTERPRET RECORDS

Our environment seems to grow noisier all the time. One noise source which has been subject to much criticism by society is the jet aircraft. In particular, the people in areas neighboring our airports find the noise levels can be most disturbing and very annoying. Continuous monitoring of the noise levels in these neighboring areas can lead to effective noise abatement efforts. The [illegible] Aircraft Noise Monitoring System, in addition to detecting excessively noisy aircraft, provides a record of the noise level for extensive evaluation in the airport noise abatement studies. For each monitoring terminal in or around the airport a Central Processing Unit integrates the noise level with intervals between measurements controlled by the computer software. Energy integrated noise levels for every required interval (minute, hour, day, month, etc.) are easily computed and recorded. Other methods of evaluation based on the dB (A) or dB (D) sound level data are possible (Noise Number Index, Community Noise Exposure Level, Total Noise Exposure Level, etc.).

FLEXIBLE

Measurements originating from each terminal are processed in the computer. Flexible software enables the sound level to be averaged on an energy basis over short or long periods of time. Weighting factors which take the time of day or night into consideration can easily be included.

SYSTEM INFORMATION

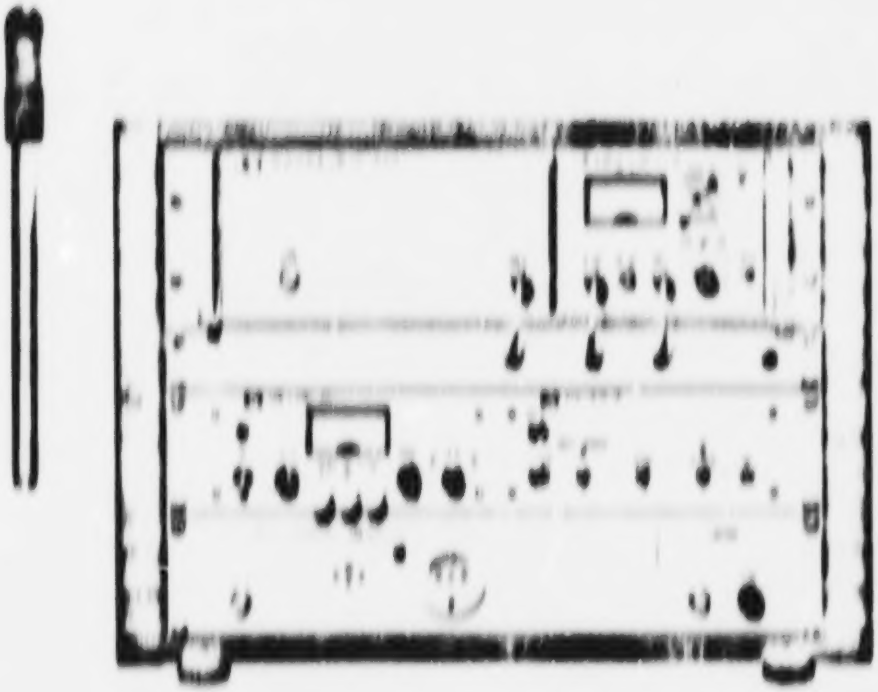
For complete system information or a quotation on an [illegible] Aircraft Noise Monitoring System designed to meet the special requirements at your airport, first call your local Hewlett-Packard field engineer. Naturally, system prices vary with the number of Noise Monitoring Terminals, optional instrumentation, and computer peripheral equipment options. The systems are tailor made to meet individual customer needs.

DESCRIPTION

The HP 80500A system consists of two basic subsystems

1. Noise Monitoring Terminal 80510B (NMT)
2. Central Processing Unit (CPU)

These two subsystems each contain a number of electronic instruments whose function will be explained as a part of the subsystem. Notice that these subsystems contain primarily standard commercial HP instruments and a minimum of specially modified equipment; therefore, no costly custom engineering for interface is required. Due to this design concept the HP 80500A Aircraft Noise Monitoring System offers a maximum of reliability and adaptability. The data is automatically processed and recorded in a form for quick evaluation. Thus, the system requires very little attendance and is highly economical to operate.



Noise Monitoring Terminal 80510B

NOISE MONITORING TERMINAL

Each individual NMT consists of a 1514BC Outdoor Microphone Assembly and the following instruments contained in a single cabinet:

1514BB	Sound Level Detector
3308A H55	DC to Frequency Converter
1518BA	Control Unit
6209C	Power Supply

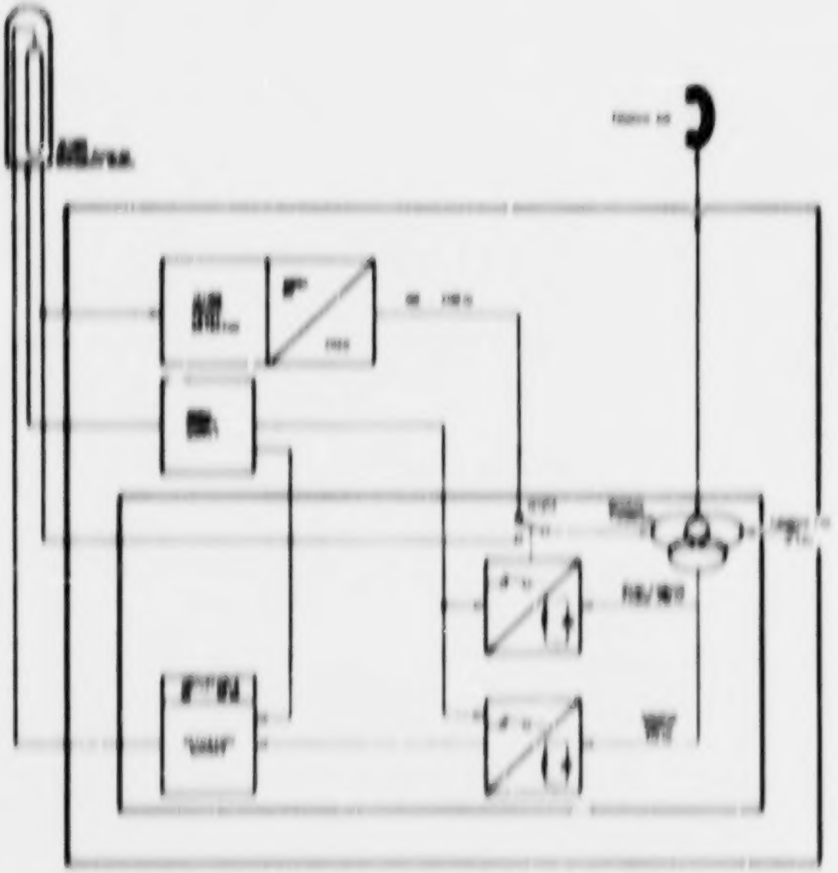
The 1514BC Outdoor Microphone Assembly, a weather-protected microphone with built-in heater and actuator meeting the IEC recommendation 179, is located outside the NMT at a suitable preselected location. The microphone is powered from a five-core cable which carries all voltages including the heater and actuator supply voltages. The microphone converts the sound present at the cartridge into an electrical signal proportional to the sound pressure. The built-in 10 dB cable amplifier allows a distance of up to 300 ft. between the microphone and the NMT.

The 1514BB Sound Level Detector produces a dc signal proportional to the logarithm of the rms value of the electrical signal from the microphone. The sound level is displayed on a front panel meter and is sent to the 3308 H55 Converter. Front panel controls allow shifting of the 50 dB measurement range for minimum measurements of 50, 60, 70, or 80 dB, selection of time constant (SLOW, FAST), and a choice of A, D, or Linear weighting.

The 3308A H55 converts the dc signal coming from the 1514BB into a proportional frequency output suitable for transmission over the telephone lines. The frequency range of the output is 600 to 3100 Hz, and the conversion factor is an output frequency change of 50 Hz for an input sound level change of 1 dB.

The 1518BA contains the matching transformer by which the information-containing frequencies are transmitted over the telephone lines to the CPU. It also contains: two frequency selective switches, an actuator source for the microphone and the telephone jack sockets for direct listening to the output of the microphone and direct verbal communication with the CPU.

One frequency selective switch is operated on receipt of a 400 Hz signal from the CPU. This is the DIRECT LISTENING CONTROL, and it routes the signal from the microphone directly to the auxiliary output telephone jack on the front panel, and from there directly to the loudspeaker in the CPU. Thus the signal bypasses all other instruments in the NMT.



Noise Monitoring Terminal [illegible]

NOISE MONITORING TERMINAL
(Cont'd)

The other frequency selective switch operates either on receipt of a 615 Hz signal from the CPU or by operation of a front panel switch of the 16166A. This is the ACTUATING CONTROL which switches on the actuating source to the microphone. The actuating source provides an adjustable voltage supply to the microphone's electrostatic actuator. This voltage is at a frequency of 1000 Hz, and the output of the microphone, when the actuator is switched on, corresponds to between 85 and 90 dB of sound pressure. Thus, the actuator control provides a means of calibrating the NMT either at the NMT or from the CPU.

The 8208 is a complete power supply unit for the 16166A and 16140B.

A telephone receiver can be plugged into the jack socket on the front panel of the control unit for either direct verbal communication with the CPU or direct listening to the sounds picked up by the microphone.

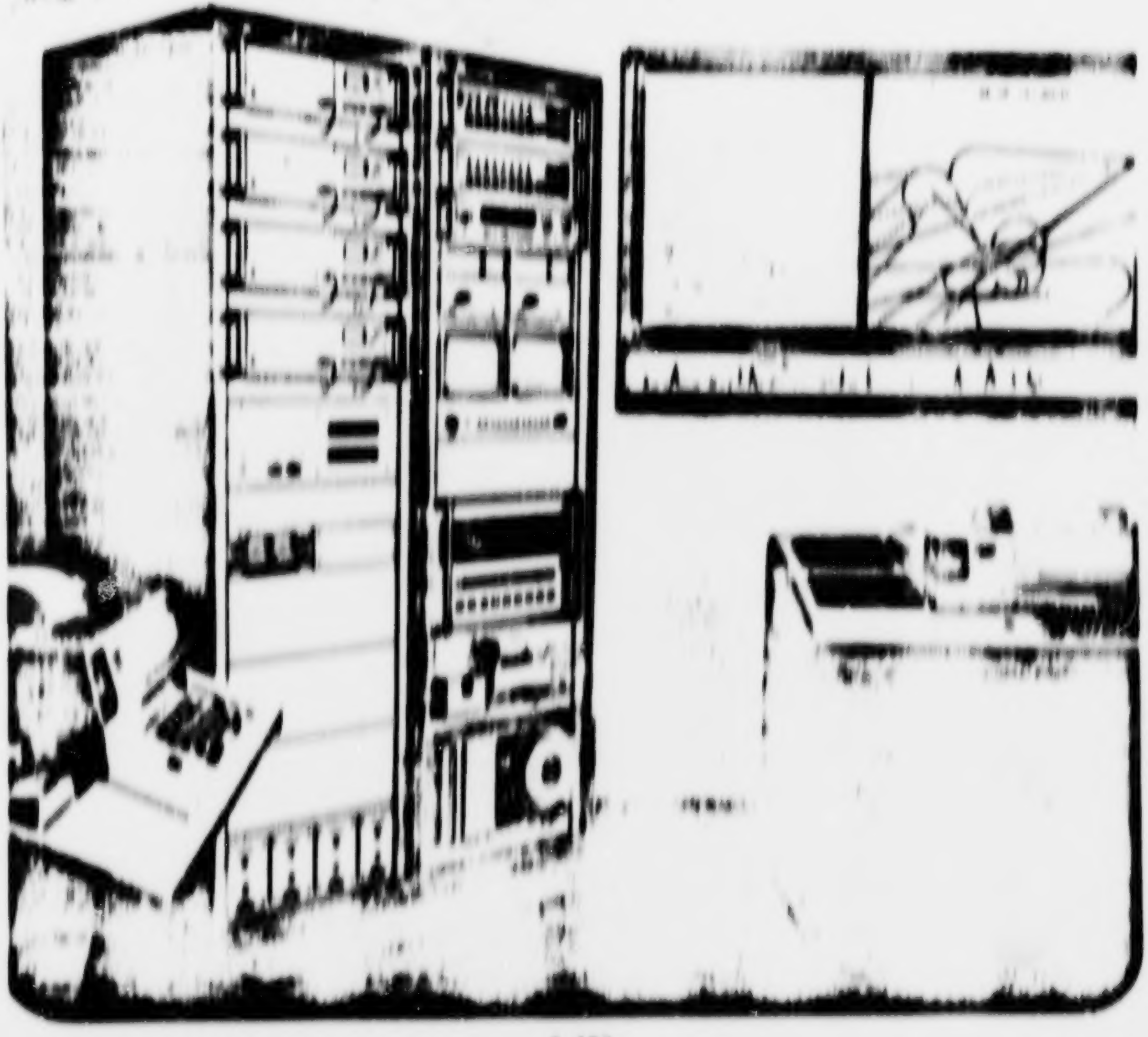
CENTRAL PROCESSING UNIT

The CPU processes the information provided by the NMT's and prints out results on teletypes. One common configuration for the CPU consists of the following instruments contained in a 2940A cabinet:

15143B	Monitoring Scanner
5326B	Frequency to Digital Converter
2114A	Computer (or any 2100 series HP computer)
2748A	High Speed Tape Reader
8100A	Tape Punch
15147A	Level Monitor
680	Level Recorder

Two teletypes are also required for operation with standard programs.

CPU AT ZURICH AIRPORT



CENTRAL PROCESSING UNIT
(Cont'd)

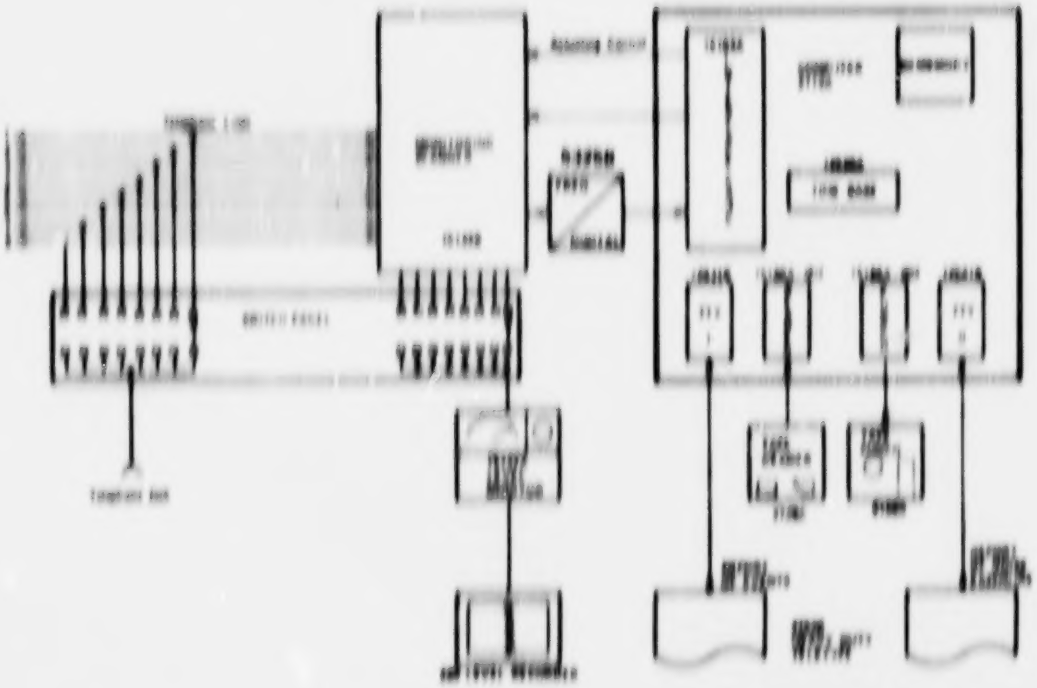
The 15143B Monitoring Scanner scans the telephone lines under computer control. One by one the signals from the various NMT's are directed to the computer through the 5326B Converter.

The 400 Hz and 315 Hz oscillators for activating the DIRECT LISTENING CONTROL and ACTUATING CONTROL switches in the NMT's are also located in the scanner.

An alarm tone triggered by the computer acts as an audio warning when the sound level from any of the NMT's exceeds a selected value. A row of lights on the scanner front panel indicates which NMT has detected the excessive noise.

The 5326B converts the frequency of the selected signal from the scanner into a digital form which serves as sound level data for processing by the computer.

The computer processes the digital data provided at its input according to the program or statistic in operation at the time. It will automatically cause a print out of the required reports at the required time on the teletypes.



Central Processing Unit (CPU)

2-190

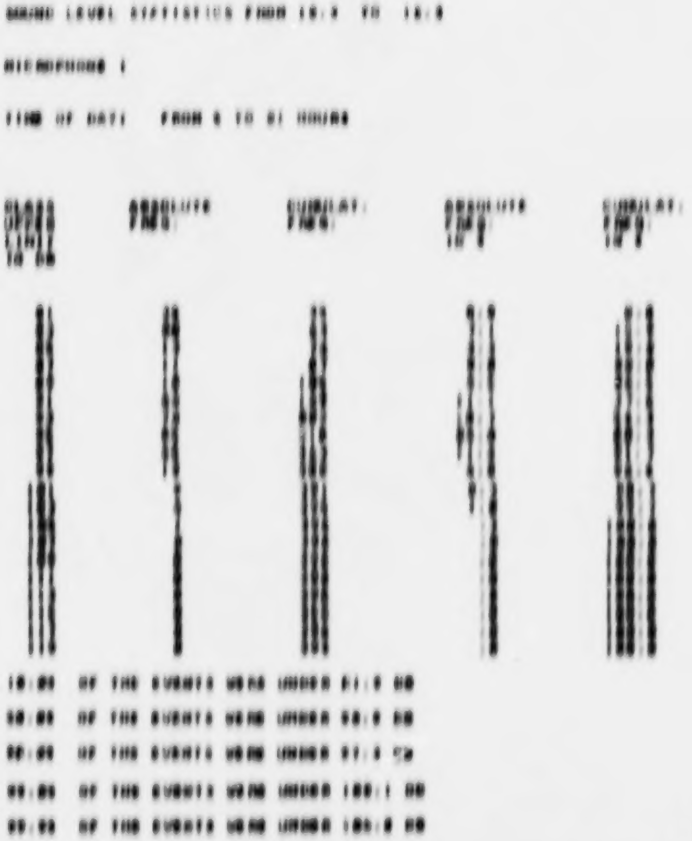
CENTRAL PROCESSING UNIT
(Cont'd)

The High Speed Tape Reader is used for reading programs or data into the computer from standard format punched tape.

The Tape Punch, operating at a much higher rate than the teletype, enables data to be gathered in a form suitable for further processing. The tape can be processed later to provide additional statistical data.

The Level Monitor acts as a frequency-to-dc converter for signals from the telephone lines. The dc levels, calibrated in dB, are indicated on a front panel meter and are fed to the Level Recorder.

The Level Recorder produces, in strip chart form, a permanent record of sound levels detected by the selected microphone.



STATISTICAL DATA
(EXAMPLE)

STANDARD SOFTWARE

Under control of standard Hewlett Packard programs, the system constantly monitors sound levels in the range of 70 to 120 dB (A). Events exceeding 80 dB are reported on a teleprinter, and if the sound level at one of the NMT's exceeds a limit set individually for each NMT by the operator, the system gives a visual and audible alarm.

Broken transmission lines are detected by the system and a report is printed giving the time and line identification. At fixed time intervals, a calibration check is initiated automatically to check the performance of the various channels from the microphone at the NMT through to the frequency to digital converter in the CPU. This check can also be performed manually at any time.

REPORT OF EVENTS

A threshold noise level is selected and written into the software; standard Hewlett Packard software uses a threshold of 80 dB. In addition to the threshold, there is an upper limit or violation limit (LIM) set by the operator for each channel; any level above the threshold up to 120 dB can be set as the violation limit.

All occurrences of noise in excess of the threshold level are recorded in a Report of Events (Figure 1). The following information is recorded for each event:

1. The microphone number.
2. The local time of day when the sound level first exceeded the threshold (TIME).
3. The violation limit set by the operator for the indicated microphone (LIM).
4. The maximum sound level detected during the event (MAX).
5. The duration in seconds in which the sound level exceeded the violation level, if at all (DUR 1). See Figure 2.
6. The duration in seconds in which the sound level exceeded the threshold (DUR 2). See Figure 2.
7. The blank column along the right hand margin labeled FLIGHT NO. is provided for manual entry of a flight number.

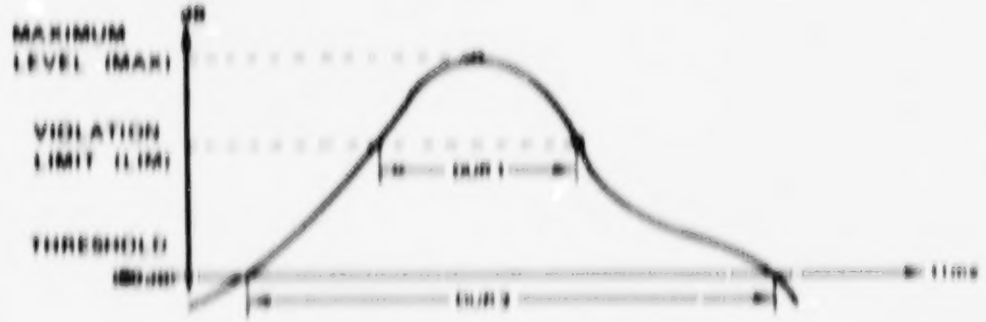
On the report in Figure 1 you can see that at 8 33 hours on 8 April 1971, microphone number 1 registered a maximum reading of 100 dB, remained over the violation limit for 1 second and over the threshold for 33 seconds.

```
REPORT OF EVENTS           6 APRIL    1971                    AIRPORT
**********************************************************************


MICROPHONE NUMBER              TIME  LIM  MAX  DUR1  DUR2   FLIGHT NO.

12 11 10 9 8 7 6 5 4 3 2 1

           8                   8:30  100   83          6
                         2     8:30  100   86          5
                           1   8:33  100  100    1    33
                       3       8:34  100   88         15
           8                   8:48  100   84          9
                         2     8:48  100   81          8
                           1   8:48  100   91         28
                         2     8:57  100   88          3
           8                   8:57  100   91         33
                         2     8:57  100   88         10
                           1   8:58  100   97         31
                    4          9: 0  100   81          3
           8                   9: 0  100   89         13
                         2     9: 0  100   87         14
                           1   9: 3  100   91         19
                           1   9:17  100   88          5
                       3       9:19  100   81          4
                       3       9:19  100   84          8
                       3       9:41  100   83         10
                           1   9:49  100   83          3
           8                   9:55  100   83         13
                         2     9:55  100   83         11
                6              9:55  100   86         13
                           1   9:56  100   93         17
              7                9:56  100   85         14
           8                  10:19  100   83          7
                           1  10:20  120   95         23
           8                  10:21  100   69          4
                         2    10:21  100   85          7
                           1  10:22  100   94         15
           8                  10:21  100   88         19
                         2    10:21  100   81          8
                           1  10:24  100   89         21
                       3      10:30  100   84         14
                       3      10:31  100   88         14
           8                  10:34  100   87         14
                         2    10:34  100   85          7
                6             10:34  100   81          6
                           1  10:34  100   94         20
                       3      10:38  100   91         19
           8                  10:38  100   84          9                Fig. 1
                  5           10:39  100   86         21
                           1  10:39  100   94         19
           8                  10:40  100   86         13
```



Curve of Variation of Sound Pressure Level Exceeding Set Limit
Durations 1 and 2 of an Event

Fig. 2

REPORT OF NOISE EXPOSURE

The computer makes a print out of the equivalent noise exposure for each microphone at three different intervals: every hour, every eight hours, every 24 hours.

Sample print-outs are shown in Figure 3 for a system with four microphones. There are four **columns** of numerical data, each column contains the data for one microphone as indicated by the top row of numbers. The print-out tells us that between **18:00** and **19:00** hours, indicated by (A), microphone 1 equivalent noise exposure was **53 dB**, the sound level never went over **80 dB**. Microphone 2 was exposed to an equivalent of **67 dB**, **36** seconds of this exposure was above the **80 dB** threshold (DUR for duration), the sound level exceeded the violation limit twice (CNT for count), etc.

Similar reports for the intervals 19:00 to 20:00 hours, 20:00 to 21:00 hours, and 21:00 to 22:00 hours are shown in the print-out. Then comes a report for the eight-hour interval between 14:00 and 22:00 hours (B), and a report for the 24-hour interval 22:00 to 22:00 hours (C). The automatic calibration report follows the 24-hour report (D); all channels responded with a preselected 80 dB.

```
REPORT OF NOISE EXPOSURE      23 AUGUST  1970

MIC        1     2     3     4     5     6     7     8     9    10    11    12

|18-19|◄(A) 54    67    72    72
DUR        0    32   197   180
CNT        0     2     8     8

19-20     47    58    63    63
DUR        0     7    29    15
CNT        0     0     1     1

20-21     74    70    60    62
DUR       32    29    52    20
CNT        1     1     1     1

21-22     59    60    67    68
DUR       11     7    50    46
CNT        0     0     2     1

14-22     66    65    68    69 |
DUR       64   124   696   688 |◄(B)
CNT        2     4    24    31 |

22-22     62    63    66    68 |
DUR      366  1604  8010  8903 |◄(C)
CNT       19    64   279   397 |
CAL       90    90    90    90 ◄(D)

22-23     55    63    66    71
DUR        0    22    95    93
CNT        0     1     3     4

23-0      55    61    65    63
DUR        0    18    26    25
CNT        0     0     1     1
```

Fig. 3

Each component of the 80500A system is covered by the standard Hewlett-Packard warranty. User programming training and maintenance training courses are included in the system price. Service and parts are available from Hewlett-Packard field offices throughout the United States, Canada and Europe. A maintenance contract can be offered and will be negotiated upon the customer's request.

ADDITIONAL HP SERVICES

SPECIFICATIONS

1514B Sound Level Meter

Frequency Range:
40 Hz to 12.5 kHz

Amplitude Range:
Sound Pressure Level, 50 to 130 dB
Sound Level (A Weighted), 50 to 130 dB
Sound Level (D Weighted), 50 to 130 dB

Dynamic Range:
80 dB

Weighting Networks:
The A network modifies the frequency response in accordance with specifications of IEC Recommendation 179. The D weighted network meets the requirements of the draft amendment to IEC Recommendation 179.

Dynamic Characteristics:
SLOW and FAST dynamic characteristics per IEC Recommendation 179.

System Accuracy

The characteristics of the Noise Monitoring System comply with IEC Recommendation 179 for precision sound level meters.

Operating Environment

Outdoor Microphone System:
−40° to +60°C (−40° to +140°F)

Noise Monitoring Terminal:
0° to 50°C (32° to 122°F),
−20° to +60°C (−4° to +140°F) with degraded accuracy.

Central Processing Unit:
10° to 40°C (50° to 104°F)
with relative humidity up to 80% at 40°C (104°F).

Dimensions

Cabinet for Noise Monitoring Terminal:
20 1/2 in. wide, 15 5/8 in. high, 15 in. deep
(520 × 397 × 381 mm)

Cabinet for Central Processing Unit:
23 1/8 in. wide, 78 in. high, 32 3/4 in. deep
(587 × 1,981 × 832 mm)

Power Requirements

Noise Monitoring Terminal:
115 or 230 V, +10% −15%, 48 to 63 Hz, approximately 100 VA

Central Processing Unit:
115 or 230 V, +10% −15%, 48 to 63 Hz, approximately 1800 VA

ENCL 3

Noise Control At Stuttgart

Hewlett Packard's computerized monitoring system leads to improved sound levels, community relations

by Guenter Kloepper

THE FIRST major jetport to install a computer-controlled system for monitoring aircraft noise, Stuttgart Airport (West Germany), reports some significant advances in the war against noise pollution.

During the two years Stuttgart's system has been in operation, the West German airport has been able to:

- Control and reduce the noise impact on populated areas near the airport by establishing effective noise abatement flight procedures.
- Significantly reduce the number of complaints about aircraft noise from Stuttgart area residents.
- Improve its relations with nearby communities.
- Collect information for drawing an accurate "noise map" of the airport for future land use planning.

Almost of equal importance, these results were obtained with the full cooperation of pilots and airlines using the airport. Stuttgart officials did not have to fine or otherwise issue violation reports to those involved in producing aircraft noise.

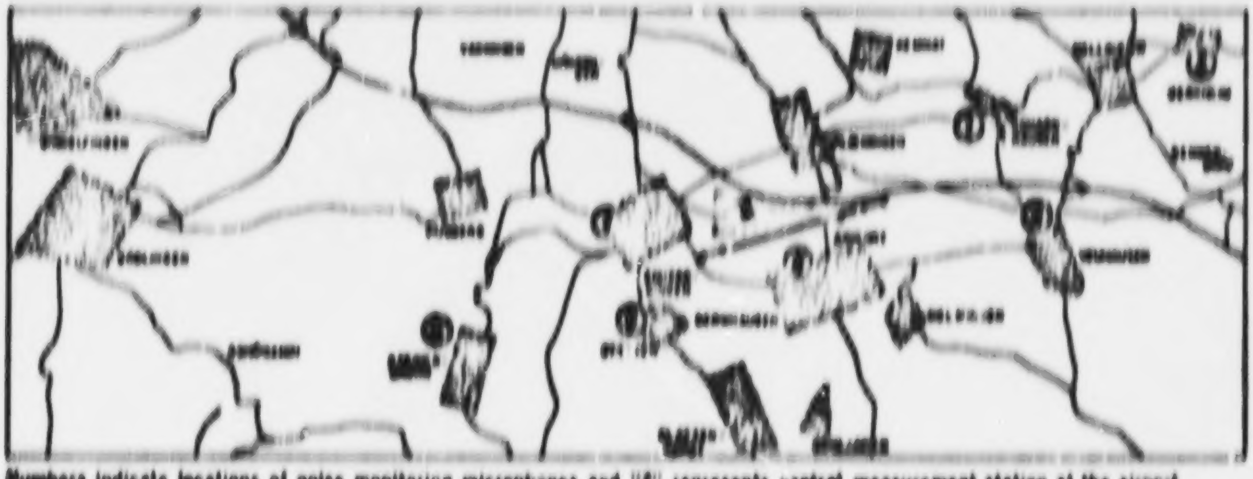
Stuttgart, one of about 300 major airports facing the unenviable job of trying to "do something" about jet aircraft noise, took a fairly elementary approach to the problem. The airport decided to begin by learning as much about the subject as possible.

In April of 1969, Stuttgart installed an aircraft noise monitoring system built by Hewlett Packard (Palo Alto, Calif.). Basically, this is a number of weatherproofed microphone terminals and other instruments which collect and feed noise data to a central station controlled by a Hewlett Packard mini-computer.

The system continuously measures sound levels at seven locations at or near the airport. It monitors each remote terminal twice every second, 24 hours a day, and immediately prints out a report whenever the predetermined noise threshold level is exceeded.

The computer report lists the time the noise threshold level was exceeded, the maximum sound level produced during the flyover, and the total length of time the threshold level was exceeded. While the Stuttgart system uses seven remote noise monitoring stations, the system is capable of handling up to 99 such terminals.

Peter M. [illegible], technical manager of the airport's Noise Eval-



Numbers indicate locations of noise monitoring microphones and "Z" represents central measurement station at the airport.

nation Center, said the ability to monitor, measure and analyze aircraft noise placed the Stuttgart Airport in a new position.

"We began to discover how much noise was present, what kind, when and where it occurred, how much was above acceptable levels, and who produced it. Once we had complete and reliable data on our noise, we started taking steps to control it," Strassner said.

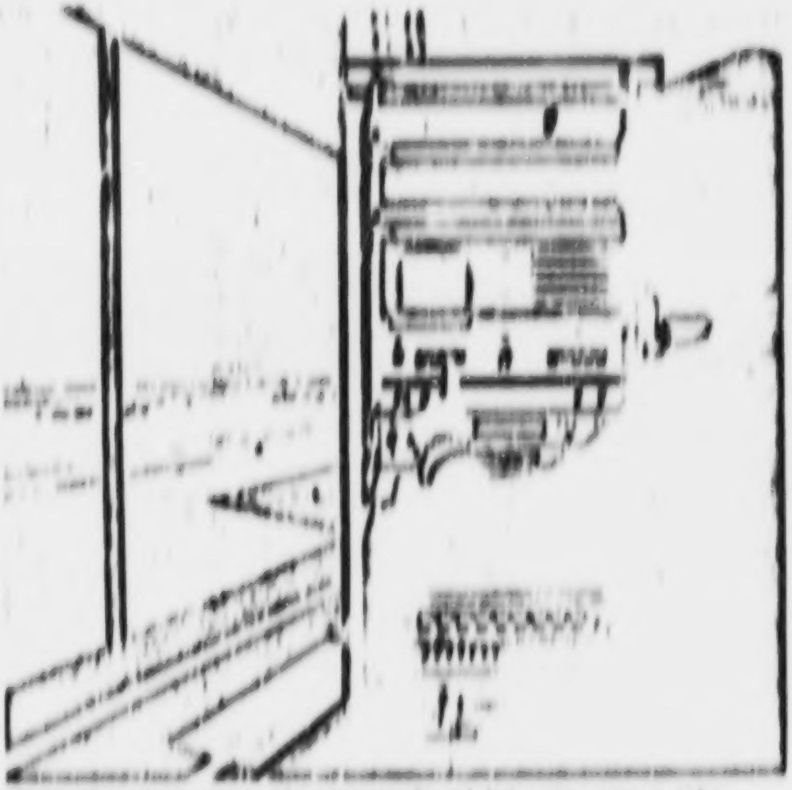
This was done primarily by devising noise abatement flight patterns. The noise monitoring system was used to develop "noise footprints" of various takeoff and landing procedures. Using this data, the airport could determine the best procedure for an arriving or departing plane specifically tailored to the type of aircraft, time of day and weather conditions—all factors which affect the amount of noise produced and where it will occur.

Stuttgart's computerized system also automatically prints out an hourly noise exposure index, and a similar report covering the entire day. Since these reports are based on some 8.6 million measurements at each monitoring terminal every month, a complete noise contour map of the airport has been developed.

Airport officials intend to use this data for land use planning, inspection of present and future types of aircraft, and determining the airport's traffic capacity.

Three approaches are currently being taken by the aviation industry to deal with the aircraft noise problem: noise abatement flight procedures, planning compatible land use around airports and development of quieter aircraft. Stuttgart's system is applied to the first two problems, although Strassner believes his airport also could assist in measuring noise from new planes seeking type certification.

The remaining category—quieter engines—has to be tackled at the source, and is enormously more expensive. In the United States, the National Aeronautics and Space Administration (NASA) plans to spend some $50 million on its "quiet engine" research, and the total cost of retro-fitting the world's current air transport fleet with acoustically treated engine nacelles could reach $1 billion.



Stuttgart's computerized system prints hourly and daily noise exposure index

While sophisticated measurement equipment such as Hewlett-Packard's aircraft noise monitoring system can be applied to set and enforce noise specifications for future engines, and to check out retrofitted planes, its most immediate value may lie in getting airports off the hot seat.

Stuttgart airport managers report a definite improvement in their relations with neighboring communities since the monitoring system was installed. To help educate and inform the public, officials also hired a noise abatement officer, Heinz Dorsdorff, a pilot whose major job is to handle complaints and inquiries.

Strassner attributes the airport's improved community relations, and the drop in local complaints, to its neighbors' realization that "the airport is interested in the noise problem to such an extent that it is willing to spend considerable time and money in modern equipment and competent personnel."

Having complete information on the noise that does occur is also important.

When an aircraft produces excessive noise levels, the system operator immediately gives a brief but detailed report to Dorsdorff. Then, if a resident telephones with a complaint, the noise abatement officer is able to provide a reason or explanation for what happened, and to support it with exact time, decibel and weather data.

Dorsdorff's telephone number has been widely publicized, and it is answered any time of day or night. He divides his time between pilots, airline officials, mayors, city councils and residents of nearby communities to discuss aircraft noise solutions.

"As all airport operators know, noise is a highly subjective thing," Dorsdorff says. "Noise that goes unnoticed by one person will be extremely irritating to another, and can result in emotional arguments that go nowhere.

"Now that we have solid information to go on, and have some experience with noise control technology, it's usually possible to convert a hot-tempered complaint into an objective discussion based on established facts and figures."

(Continued on next page)

NOISE CONTROL continued

Stuttgart officials are especially pleased by the enthusiasm and cooperation shown by nearly all the pilots and airlines using the airport.

Instead of being suspicious about Stuttgart's noise monitoring system, pilots have voluntarily visited the Noise Evaluation Center to find out more about it, and to learn how they can improve their noise performance. This is particularly true of pilots for smaller airlines and charter services, since they have more contact with the airport than larger airlines which file their flight plans elsewhere.

Both large and small airlines, working with the airport's noise monitoring group, have tested and are continuing to try various noise abatement flight procedures to see which are most effective for particular types of aircraft.

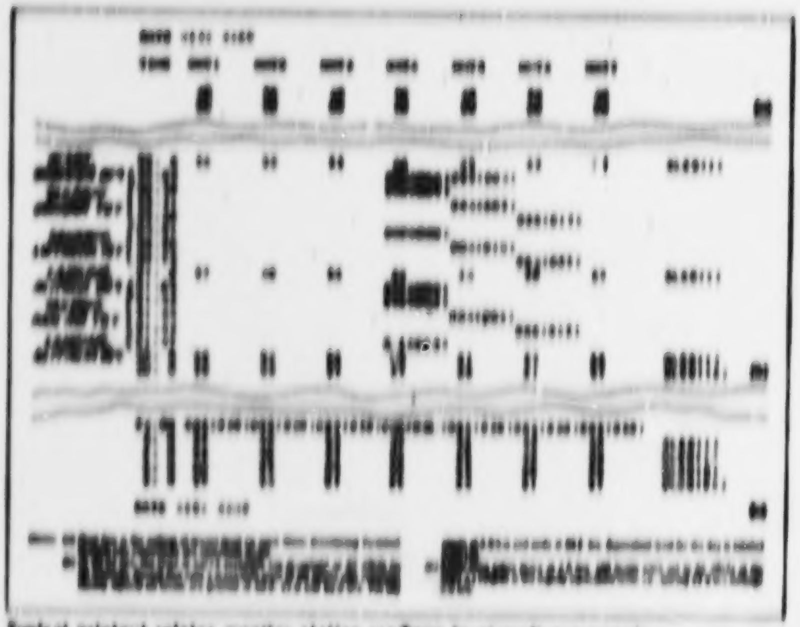
Stuttgart's good working relationships with its users is apparent in a monthly noise report issued by Bosdorff. It lists complete tabular data on all flights during the month, including noise limit violations by date, exact time, airline, flight number and type of aircraft. Deviations from prescribed routes are also listed, along with any complaints which resulted, and comparisons with the previous month's results.

All this is listed without comment. Bosdorff's accompanying remarks are brief and courteous, describing new flight patterns being tested by individual airlines, and summarizing any changes in noise abatement procedures.

Strasser explains that no one is taken to task for deviations because "everyone involved is doing the best they can. Our users are cooperative and good-willed people. Our job is to let them know how they're doing, and to work together to come up with the best possible noise control program. They're as interested in solving the problem as we are."

The success of Stuttgart's program has attracted visits by representatives of at least a dozen other international airports near the noise saturation point. European airports, because of population density and pending legislation, currently are more active in placing similar systems in operation.

Geneva and Zurich recently have installed Hewlett-Packard noise monitoring systems, and major terminals in the United States are investigating the feasibility of similar equipment.

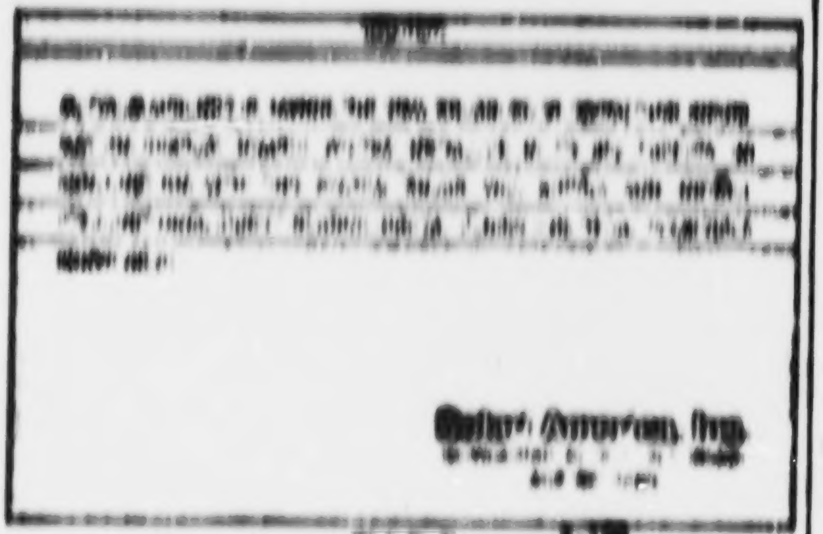


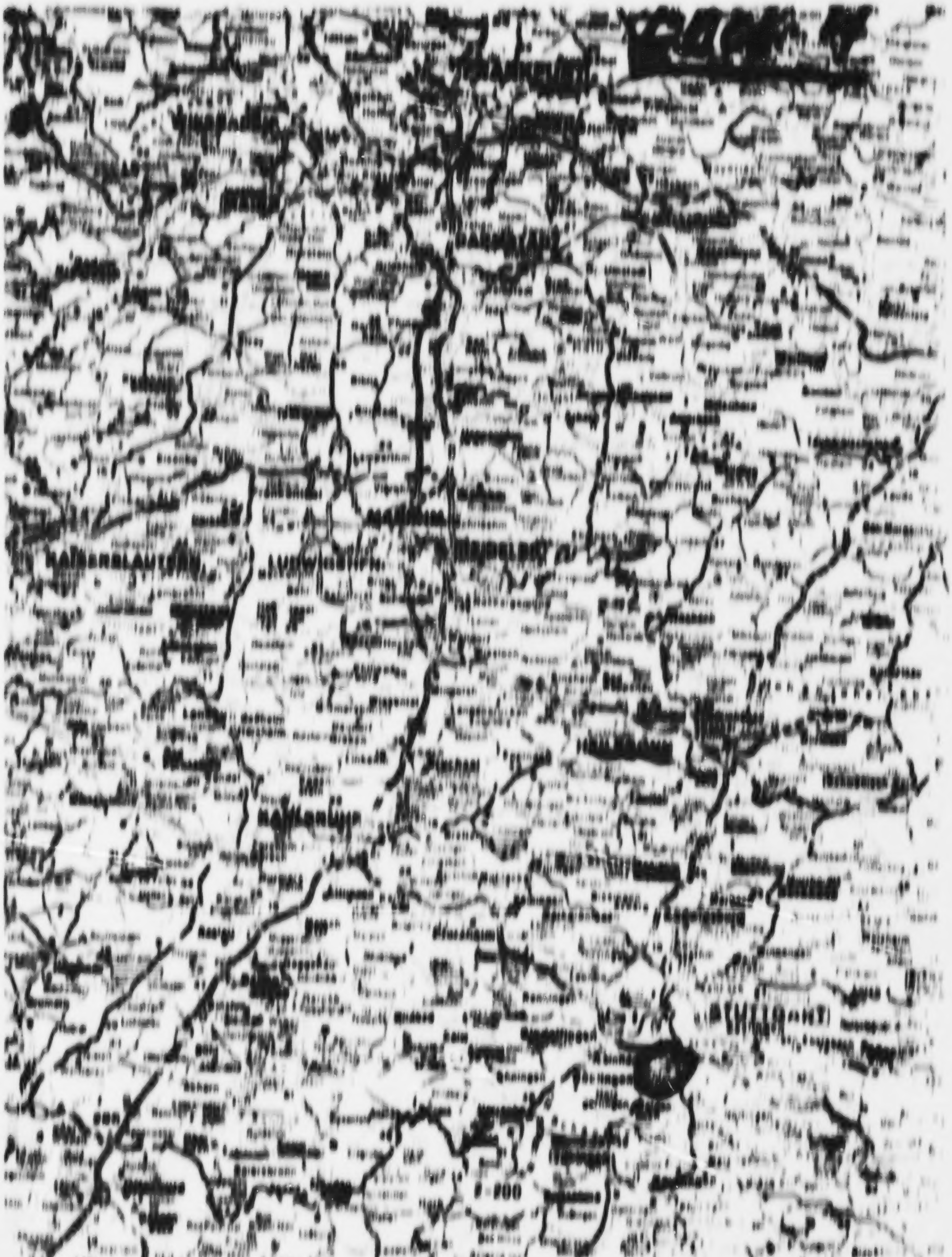
Typical printout relates monitor station readings to aircraft movements.

Solari

is seen by all

Solari American, Inc.





2.13 SCHIPHOL AIRPORT, AMSTERDAM

Ministerie van Verkeer en Waterstaat
Rijksluchtvaartdienst
Luchtvaartinspectie
Schiphol-Oost · Hangaar 6 · Catoriaweg · Postbus 7555 · Telefoon 020 - 170876 · Telex [illegible] · Telegramadres CIVILINSPEC

To: Hydrospace-Challenger Inc.
1360 Rosecrans Street
San Diego, California 92106
Attention: Mrs. Carole S. Tanner

Uw brief van 9 July 1974
Uw kenmerk
Onderwerp Noise monitoring

Schiphol 20 August 1974
Ons kenmerk LI/02 4017
Bijlage(n)

Dear Mrs. Tanner

Your request for a description of the noise monitoring installation at Schiphol Airport (Amsterdam) was forwarded by the Airport Management to us being the responsible authority.

Enclosed please find the relevant details of this system.

Yours truly,

A.H.Vink
Bureau of Noise Affairs
Aeronautical Inspection
Directorate

Verzoeke bij Uw antwoord kenmerk en datum dezes te vermelden en slechts één zaak in één brief te behandelen

AIRPORT LOCATION AND PHYSICAL FEATURES

LOCATION
SCHIPHOL AIRPORT
AMSTERDAM/ NETHERLANDS

LATITUDE
52° 18' 23" N

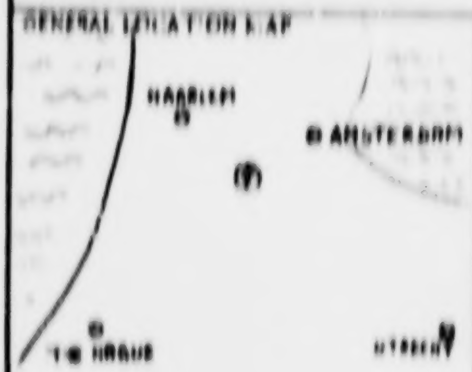
LONGITUDE
04° 45' 46" E

ELEVATION
- 15 ft.

TERRAIN
in-land airport, surrounded by flat terrain

APPROACHES
Populated residential areas

GENERAL LOCATION MAP



TOTAL JET OPS
350 /day

DAY
255

EVE
70

NIGHT
25

NIGHT RESTRICTIONS
see note 1.

DATE INSTALLED
July 1969

THRESHOLD
85 dBA 2)

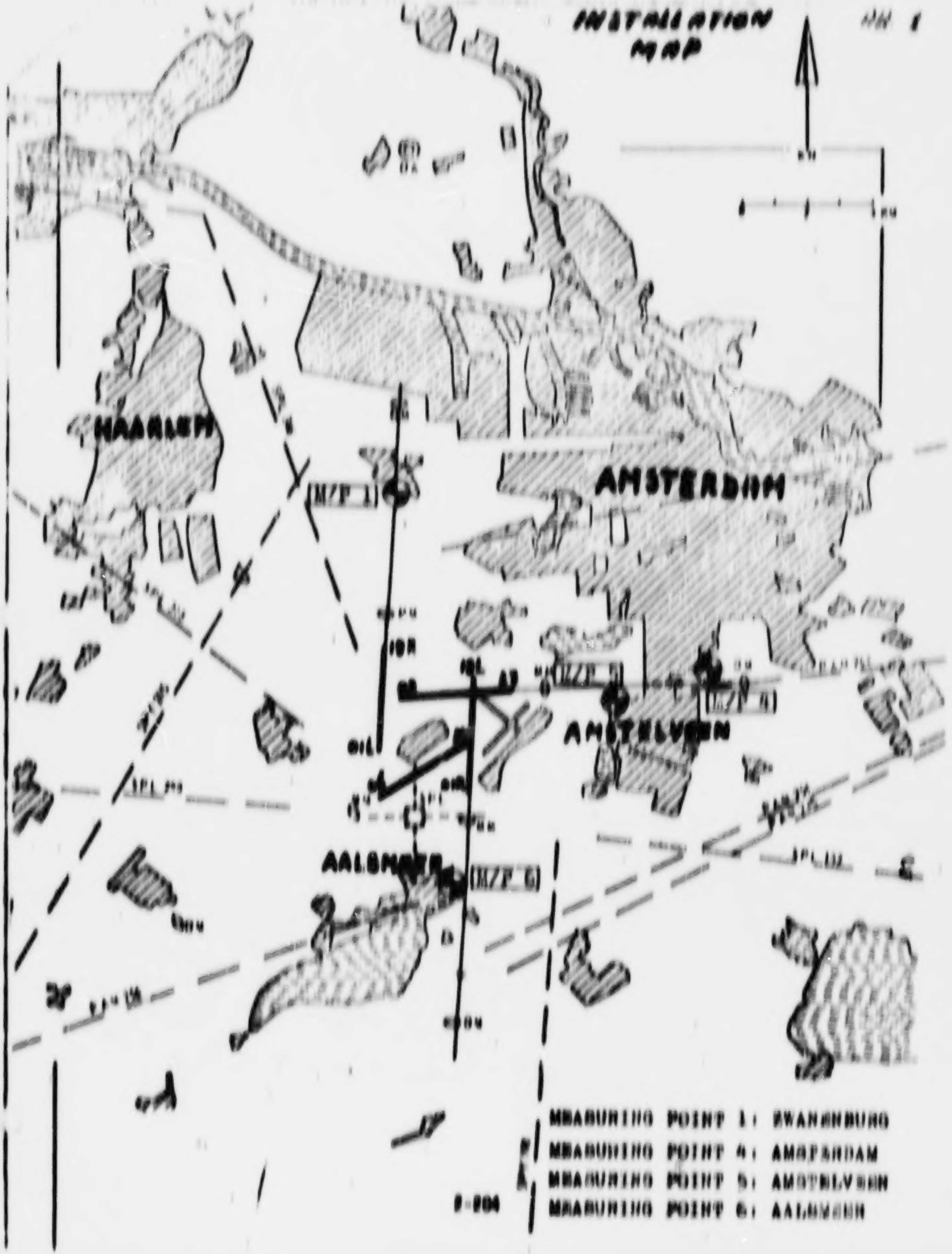
TERMINAL TRACKING/
ILS 01R
ILS 19R
ILS 27

VIBRATION HISTORY
History of complaints from residences around airport.

INSTALLATION MAP

see map, attached.

INSTALLATION MAP



HAARLEM
AMSTERDAM
AMSTELVEEN
AALSMEER
M/P 1
M/P 4
M/P 5
M/P 6
MEASURING POINT 1: ZWANENBURG
MEASURING POINT 4: AMSTERDAM
MEASURING POINT 5: AMSTELVEEN
MEASURING POINT 6: AALSMEER

AIRPORT LOCATION AND PHYSICAL FEATURES, Contd

SYNOPSIS OF SYSTEM:

Monitors 4 locations continuously per peak dBD.
System is also capable of calculating time integrated and equivalent noise levels.
Remote sites consist of Rohde & Schwarz all-weather microphones, precision sound level meter, DC to frequency converter and control signal receiver.
Transmission by voice-grade telephone line, via common exchange centre.
Calibration by electrical insert (50 Hz square wave) at site or commanded from the airport, manually or automatically.
Raw acoustic signal can be monitored at the airport.
Central processing unit consists of 4 frequency to DC converters, scanner and A/D-converter, PDP8L minicomputer with memory expansion (8K), reader/puncher, display panel, interface unit, real time clock and two teleprinters (Teletype ASR 33).
Via teleprinter 1: events over threshold and calibration results are recorded. Recording consists of time of peak level (h,min,sec) measuring point, peak value, time integrated value, duration, class, excursion over violation reference level, duration and reference level.
Via teleprinter 2: noise exposure index table per site, per hour, commands to computer.
Time history of events above threshold can be recorded by tape puncher.
For traffic and general information:
Runway status indicator
Teleprinter for ATC in- and outbound messages
TV-monitor for Met.office and ATC information
Radio monitor for Tower and Approach frequencies

NOTES:

1) Between 2230 GMT and 0500 GMT, jet aircraft without noise certification may only use runways 06, 24 and 01L.
Runway 24 to be exclusively used for take-off, runway 06 to be used exclusively for landing.
Runway 01L to be used exclusively for take-off, when the use of 24 is impossible due to safety reasons. The use of runway 01L however, is limited to departing aircraft with less than four engines. During above-mentioned period, supplementary Standard Instrument Departures have to be adhered to.

2) Recording threshold all sites: 85dBD
Violation reference level : 95dBD
Events with a duration of less than 5 seconds are not recorded.

AIRPORT TYPICAL WEATHER CONDITIONS

WEATHER MEASUREMENTS AT AIRPORT

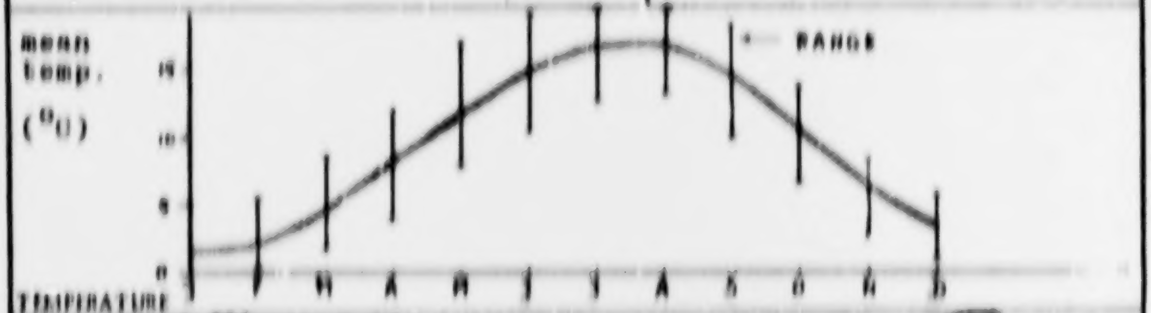
Dept. of Transport and Public Works
Royal Dutch Meteorological Institute
Station Schiphol

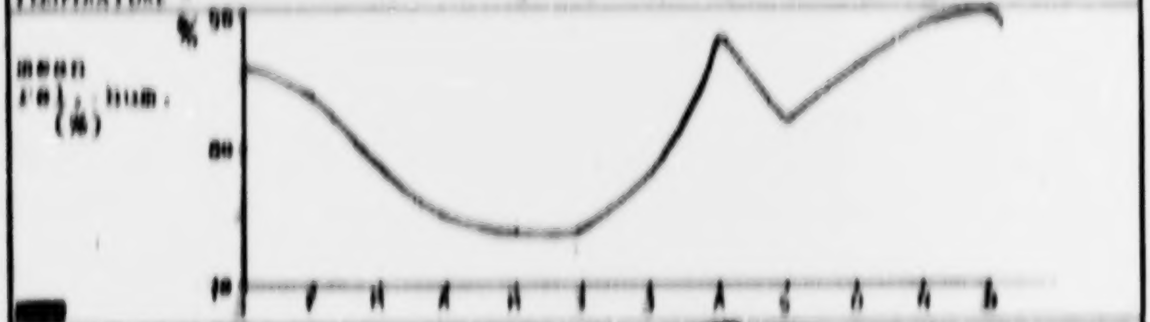
TEMPERATURE
9 °C yearly mean

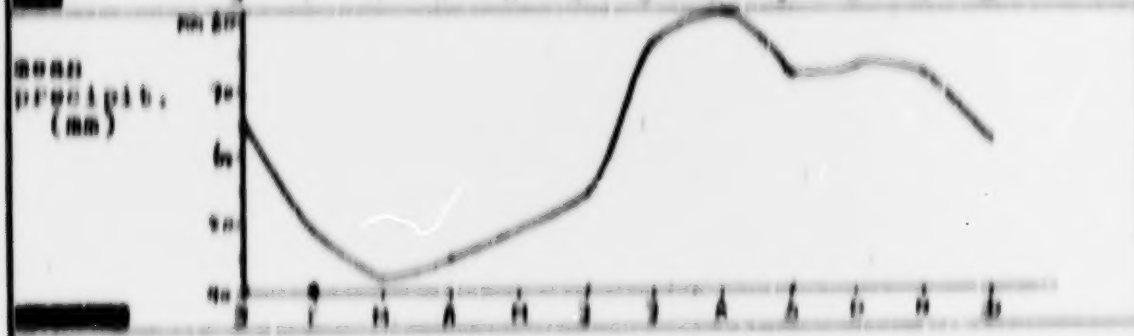
HUMIDITY
82 % yearly mean

WIND
240° 12 kts yearly m.

RAINFALL
62 mm. yearly mean







NO APPROPRIATE DATA AVAILABLE

WIND

TOTAL SYSTEM PERFORMANCE

NOISE STANDARD, LAW, REGULATION GOVERNING SYSTEM DESIGN

Noise law and standards in preparation.
At Schiphol Airport (noise-preferential runway selection

UNIT OF NOISE MEASUREMENT

dBD above a threshold

RANGE AND RESOLUTION OF NOISE THRESHOLD SETTING

50 to 140 dBD, in 0.1 dB steps

VIOLATION DETERMINATION

dBD above a violation threshold of single event

VIOLATION THRESHOLD RANGE AND RESOLUTION

50 to 140 dBD, resolution 0.1 dB

VIOLATION LIMIT RANGE AND RESOLUTION

50 to 160 dBD, resolution 0.1 dB

ON LINE/OFF LINE DATA AVAILABILITY

on line

PERCENT UTILIZATION OF SYSTEM

continuous

TIME TO INSTALL OR ACTIVATE SITE

not applicable

WEATHER REQUIREMENT AT SITE

all-weather operation

DATA USAGE

- ☒ LITIGATION INVOLVING NOISE LEVELS
- ☐ PHYSICAL ACOUSTICAL RESEARCH
- ☒ COMMUNITY RESPONSE
- ☐ AIRPORT PLANNING
- ☐ CERTIFICATION OF AIRCRAFT

DATA REVIEWED BY:

- ☒ AIRPORT OPERATOR
- ☐ CITY, COUNTY
- ☐ STATE
- ☒ FEDERAL
- ☐ ACOUSTICAL CONSULTANT
- ☐ ENVIRONMENTAL GROUPS
- ☒ AIRCRAFT OPERATORS

TOTAL SYSTEM ACCURACY	SYSTEM RESOLUTION	SYSTEM RANGE
± 1 dB	0.1 dB	50 to 160 dBD

SYSTEM OPTIONS/EXPANDABILITY

Provisions included for later expansion to 16 sites.

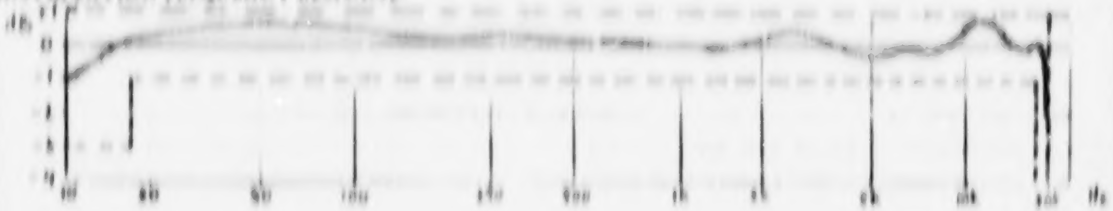
REMOTE SITES - ACOUSTIC SENSORS

TYPE ROHDE & SCHWARZ BN 454629	**NUMBER** 4

INSTALLATION

Pole-mounted, approx. 10 ft. above obstructions

INSTALLATION FREQUENCY RESPONSE



LINEARITY 0.01 dB		**TEMP COEFFICIENT** -0.005 dB/°C	**PRESSURE COEFFICIENT** less than 0.2 dB/100 mb.
HUMIDITY COEFFICIENT less than 0.1 dB (rel.hum. 0-95%)	**WINDSCREEN** Metal cilindrical	**BIRD PROTECTION** none	**LIGHTNING PROTECTION** none

PREAMP GAIN

0.995

MIN NOISE LEVEL OF MIC/PREAMP

26 dBA

PHOTO

NOTES

REMOTE SITES - EQUIPMENT

SIGNAL CONDITIONING D-weighting network used by operator
A-,B-,C-,linear or external filter networks can be selected

GAIN RANGES A-,B-,C-,linear: 25-160 dB
D : 30-160 dB

GAIN SELECTION
Dynamic range 50 dB,selecteable in 10 dB steps

DETECTION slow responding D-weighting

RMS - LOG CONVERSION not applicable

MODEM
Raw acoustic to DC-,DC to frequency conversion

SAMPLE RATE continuous	**MESSAGE CONTENT** n.a.

ACOUSTIC CALIBRATION
n.a.

INSERT CALIBRATION
50 Hz square wave,amplitude stabilised

ACTUAL MONITORING or at central display
By remote control on actual link(speaker), unit (meter display)

REMOTE CONTROLLABLE FUNCTIONS
calibration,monitoring raw acoustic signal

SIZE 600x550x480 mm	**WEIGHT** 70 lbs	**TEMP RANGE** 20°F - 140°F
CONSTRUCTION 19"-racks	**POWER REQUIREMENTS** 220 VAC,25 W	**TIME OF UNATTENDED OPERATION** time between failures

COMMUNICATION
Telephone handsets,using actual monitoring channel

PHOTO

NOTES

TRANSMISSION LINK

TYPE voice-grade telephone line

CHANNELS PER SITE 0

PATH LENGTH 15 to 35 km through 3 automated exchanges

TRANSMISSION POWER LEVEL $0\ldots1\ V_{eff}$ in 600 Ohm

FREQUENCY RESPONSE OF CHANNEL 300-3000 Hz

DYNAMIC RANGE 20-30 dB

MODEM

MESSAGE RATE continuous

BIT RATE not applicable

MESSAGE CONTENT frequency,proportional to noise level

ERROR DETECTION n.a.

ERROR CORRECTION n.a.

MESSAGE FORMAT n.a.

CENTRAL DATA PROCESSING AND DISPLAY

TYPE OF PROCESSOR

General purpose minicomputer
Digital PDP-8L, with 4K memory expansion MC8/L

SUBSYSTEMS AND EQUIPMENT CONFIGURATION

1. Tape reader/puncher
2. A/D-converter
3. Real time clock
4. Teletype ASR33 teleprinters(2)
   Siemens teleprinter (1)
5. Monitoring and calibration unit
6. Interface unit

DISPLAYS, ALARMS, MONITORS

1. Panel meters for noise level at sites(continuous)
2. Violation display panel
3. Audio monitor of selected sites
4. System failure indicator
5. Power failure indicator
6. Calibration and checking indicator.

NO. REMOTE SITES 4	PROVISION FOR NEW SITES 10
SIZE 1,80x1,20x0,60m.	WEIGHT 800 lbs
POWER 220 VAC,1500 W	TEMP RANGE 50 to 140^{0}F

TIME OF UNATTENDED OPERATION

Approx. 2500 hours for teletype paper.

LOGS

1. events above threshold level
2. events above violation reference level
3. Calibration results
4. Noise exposure index per site per hour (daily log)
5. Time history of events above threshold (punched tape)

PHOTO

NOTES

1. For general information on weather, ATC-data and airport traffic following monitors and indicators have been installed:
   a. Runway status display
   b. TV-monitor (ATC and Met. office channels)
   c. Radio monitor for Tower and Approach frequencies
   d. Teleprinter for ATC-airport traffic messages

CENTRAL PROCESSING SOFTWARE

NUMBER WORDS OF PROGRAM	NUMBER WORDS OF DATA
NUMBER WORDS SPARE	PEAK PERCENTAGE UTILIZATION OF COMPUTER
METHOD OF LOADING PROGRAM Fast tape reader	PROVISIONS FOR ERROR MESSAGES Erroneous operator inputs flashed
NUMBER OF OPERATOR INPUTS	

TRACKING

TYPE

none yet used at schiphol airport

RANGE COVERAGE	RANGE ACCURACY	RANGE RATE
BEARING COVERAGE	BEARING ACCURACY	BEARING RATE
ALTITUDE COVERAGE	ALTITUDE ACCURACY	ALTITUDE RATE
NUMBER TRACKING SITES	LOCATION	
ACTIVE/PASSIVE TARGETS	TRANSPONDER OR BEACON	
ANALOG/DIGITAL RECORDING OF DATA	REAL TIME PLOT OF TARGET	PLOT SCALE
RECORDED DATA ACCURACY	OFF LINE PROCESSING TURNAROUND TIME	PLOT ACCURACY
PROCESSED PLOT OF TARGET	PROCESSED PLOT SCALE	PROCESSED ACCURACY
LINE PRINTER PARAMETERS LISTED		
RATE PARAMETERS ARE LISTED ON LINE PRINTER		

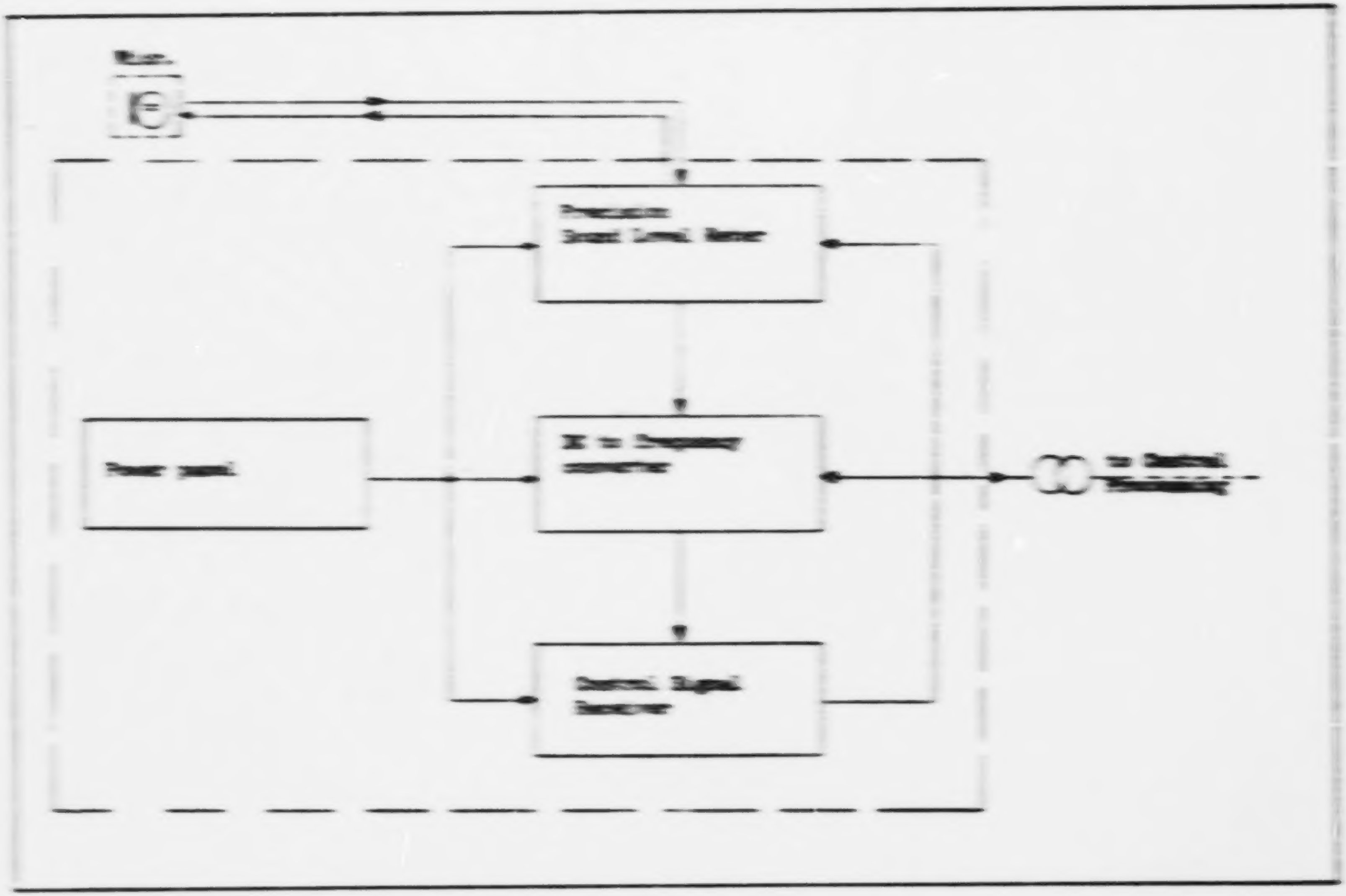
PHOTO	NOTES

SYSTEM COST/SCHEDULE

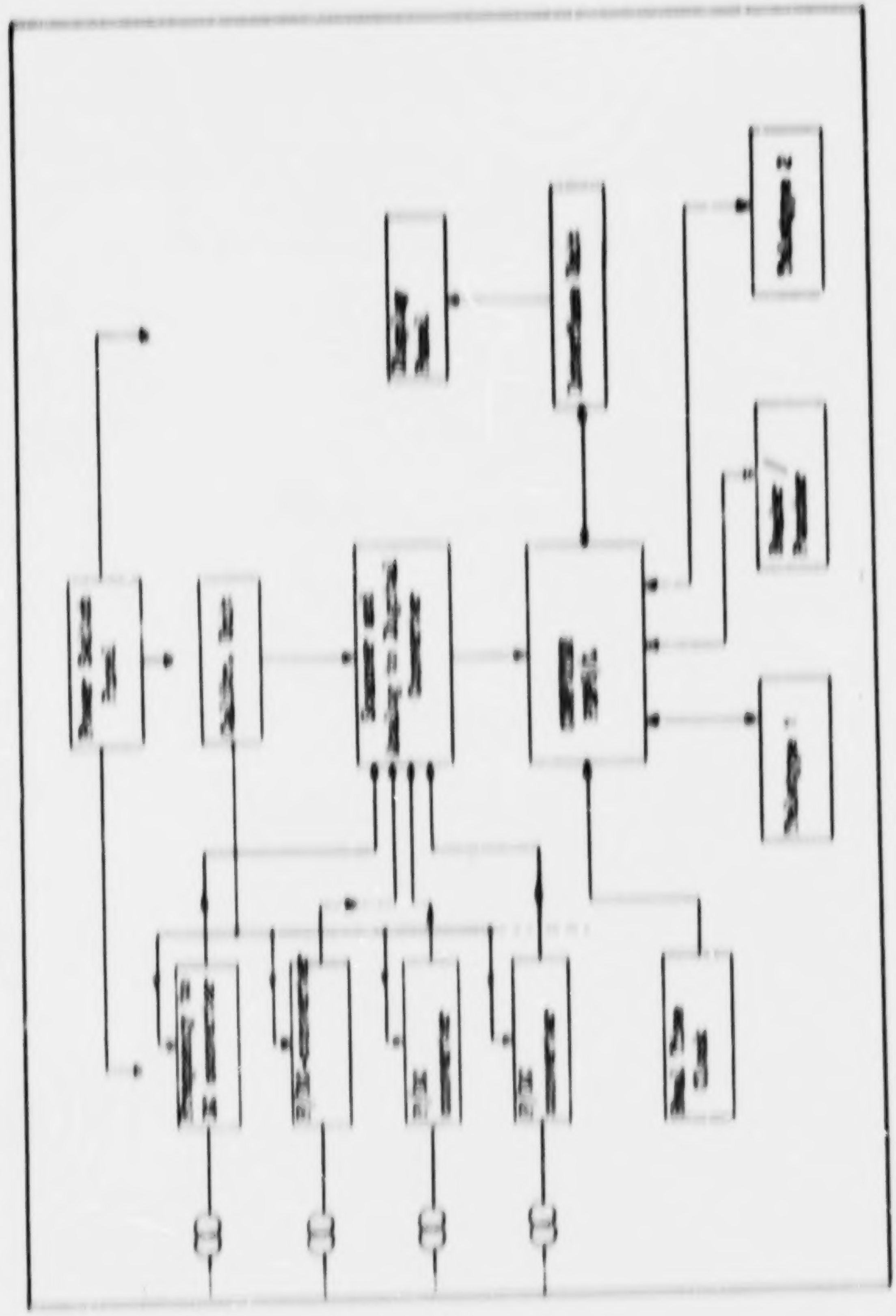
DESIGN COST	DESIGN MAN MONTHS	DESIGN PERIOD
PROCUREMENT COST	PROCUREMENT MAN MONTHS	PROCUREMENT PERIOD
SYSTEM COST INSTALLED $ 125,000	MANUFACTURE MAN MONTHS	MANUFACTURE PERIOD

YEARLY MAINTENANCE COST $ 4250	RENTAL/LEASE COST PER YEAR
OPERATIONS COST $ 2,000 yearly	LIFE EXPECTANCY 15 years
CURRENT REPLACEMENT COST $ 180,000	
PERSONNEL REQUIREMENTS IN NUMBER PEOPLE AND MAN HOURS PER YEAR MAINTENANCE 1 MAN HOURS 15 OPERATION 1 MAN HOURS 1 DATA REVIEW 1 MAN HOURS 600	

REMOTE SITE BLOCK DIAGRAM


Mic.
Precision Sound Level Meter
DC to Frequency converter
Power panel
Control Signal Receiver
to Central Processing

[illegible]



For overall system block diagram,
combine block diagrams for remote site and central
processing unit.

8.14 FRANKFURT, GERMANY

[redacted]

Flughafen Frankfurt/Main AG 6 Frankfurt am Main 75

Hsi & G
Hydrospace-Challenger, Inc.
Attn: Mrs. C. S. Tanner

1900 Rosecrans Street,

San Diego, California 92106

USA

Sitz der Gesellschaft Frankfurt am Main
Amtsgericht Frankfurt am Main HRB [illegible] 7042

Fernruf 0611 · 690 Durchwahl 690 8700
Drahtwort Air Frankfurt/Main
Fernschreiber und
Bankverbindungen umseitig

Ihr Zeichen	Ihre Nachricht	Unser Zeichen	Frankfurt am Main-Flughafen
CSTich	9.7.1974	PB 31 be/mf	August 9th, 1974

Subject: Noise Monitoring Systems

Dear Mrs. Tanner!

In reference to your letter of July 9th you will find enclosed the questionaire you requested, which we trust will be of help for your report.

In contrast to many other places we feel it is unfair to speak about a violation if an aircraft exceeds an arbitrary specified threshold and on the other hand allow all avoidable noise below this threshold. We insist that a quieter aircraft should also be handled quiet by pilots and therefore we calculate (as can be seen from the att. No. 2) a Monthly Noise Average for each A/C type operating from Frankfurt airport which is used as a measure to judge the various airlines on a basis of the fleet.

In addition, we found that it is most important to include the weather situation in the calculation, as can be seen from the enclosed lists.

In the meantime our method is accepted by the airlines as an objective way to judge A/C noise.

With satisfaction we acknowledge the effort of companies to improve their rank in the list.

By this method the airlines are stimulated competition minded and step by step their environment consciousness is being improved.

Some of our answers to your questions have been devided into present and future. Since the NOVA computer will be integrated by the end of 1974 that means all statements given under future will be as of January 1st, 1975.

- 2 -

B-219

We are highly interested in your survey and therefore kindly ask you to send us a copy of your summary.

Please feel free to contact us if special questions might arise in connection with the questionaire or on the enclosed literature. We will be happy to discuss our experiences with you in detail upon request.

Sincerely,

Flughafen
Frankfurt/Main AG
Öffentlichkeit und Umwelt

i.V. Husborn

Pisis Husborn

Enclosures

AIRPORT LOCATION AND PHYSICAL FEATURES

LOCATION
Frankfurt, Germany

LATITUDE
50° 02' N

LONGITUDE
08° [illegible]

ELEVATION
360 ft

TERRAIN
airport surrounded by forest

APPROACHES
populated residential area

GENERAL LOCATION MAP
attachment No. 1
(map)

TOTAL JET OPS
450

DAY
400

EVE

NIGHT
50

NIGHT RESTRICTIONS
see note
next page

DATE INSTALLED
1965

THRESHOLD
see page 4 violation determination

VIOLATION HISTORY
violations are issued by government and not by airport authority

TERMINAL TRACKING/
ILS RW 25 R
ILS RW 25 L
ILS RW 07 L

INSTALLATION MAP
attachment No. 1
(map)

AIRPORT LOCATION AND PHYSICAL FEATURES, Contd

SYNOPSIS OF SYSTEM

present:

12 monitors, locations as per enclosed map att. No. 1
1 movable monitor, van mounted
range: 68 - 106 dB(A) in 10 classes

future:

16 monitors

9 installed at fixed locations

7 movable, used to control 15 areas
over a period of 3 - 6 month each

NOTES

curfew:

00 - 03 no approaches (except USAF)
23 - 00 and 03 - 04 only approaches for airlines with homebase at FRA

no restrictions for departures

AIRPORT TYPICAL WEATHER CONDITIONS

WEATHER MEASUREMENTS AT AIRPORT	
AIRPORT WEATHER SERVICE STATION	TEMPERATURE 48,5 °F HUMIDITY 77,3 WIND 6 RAINFALL 686

J	F	M	A	M	J	J	A	S	O	N	D
33	34	40	48	56	62	65	63	58	49	41	34

TEMPERATURE °F

J	F	M	A	M	J	J	A	S	O	N	D
1,8	1,6	1,7	2,0	2,0	3,1	2,6	3,7	2,2	2,0	2,3	2,2

RAIN inch

J	F	M	A	M	J	J	A	S	O	N	D
85	81	75	70	68	69	70	74	79	84	86	87

HUMIDITY %

WIND

TOTAL SYSTEM PERFORMANCE

NOISE STANDARD, LAW, REGULATION GOVERNING SYSTEM DESIGN

UNIT OF NOISE MEASUREMENT

see note A next page

RANGE AND RESOLUTION OF NOISE THRESHOLD SETTING

N. A.

VIOLATION DETERMINATION

see note B next page

VIOLATION THRESHOLD RANGE AND RESOLUTION

N. A.

VIOLATION LIMIT RANGE AND RESOLUTION

N. A

ON LINE/OFF LINE DATA AVAILABILITY

on line

PERCENT UTILIZATION OF SYSTEM

continuous

TIME TO INSTALL OR ACTIVATE SITE

WEATHER REQUIREMENT AT SITE
no operation due to wind
noise above 15 Kn comp.

DATA USAGE

☐ LITIGATION INVOLVING NOISE LEVELS
☐ PHYSICAL ACOUSTICAL RESEARCH
☒ COMMUNITY RESPONSE
☒ AIRPORT PLANNING
☐ CERTIFICATION OF AIRCRAFT

DATA REVIEWED BY:

☒ AIRPORT OPERATOR
☐ CITY, COUNTY
☐ STATE
☐ FEDERAL
☐ ACOUSTICAL CONSULTANT
☐ ENVIRONMENTAL GROUPS
☒ AIRCRAFT OPERATORS

TOTAL SYSTEM ACCURACY

SYSTEM RESOLUTION

SYSTEM RANGE
50 dB(A)

SYSTEM OPTIONS/EXPANDABILITY

will be expanded to 23 MP within 6 month
additional expansion possible

Note A

Unit of noise measurement:

present:

WR (= effective duration) see attachment No. 2
which is similar to L_{EPN}

future:

L_{EPN} in accordance with ISO R 507
an A weighted L_{EPN} without tone correction
on the basis of 10 sec

Note B

Violation determination:

depending on approach or departure noise average of the A/C type in question which is calculated every month under consideration of 8 - 12 different weather categories

REMOTE SITES - ACOUSTIC SENSORS

TYPE
Rohde & Schwarz, Munich

NUMBER
present: 12 + 1
future: 16 + 1

INSTALLATION
pole mounted 20 ft above obstructions

INSTALLATION FREQUENCY RESPONSE
30 - 12 000 Hz

LINEARITY
-

TEMP COEFFICIENT
-

PRESSURE COEFFICIENT
-

HUMIDITY COEFFICIENT
-

WINDSCREEN
yes

BIRD PROTECTION
yes

LIGHTNING PROTECTION
-

PREAMP GAIN
-

MIN NOISE LEVEL OF MIC/PREAMP
-

PHOTO

NOTES
detailed data available
on special request
from manufacturer

REMOTE SITES – EQUIPMENT

SIGNAL CONDITIONING: present: A weighting network future: signals < 5 sec and > 120 sec are rejected by computer software		
GAIN RANGES 60 - 140 dB(A)		
GAIN SELECTION 50 dB range selectable		
DETECTION slow responding A-weighting network		
RMS - LOG CONVERSION analog		
MODEM D/C frequency converter to transmit analog dB value via 30 - 3000 Hz telephone line		
SAMPLE RATE N.A.	**MESSAGE CONTENT** pulse train proportional to dB value	
ACOUSTIC CALIBRATION hand held pistophone placed on mic.		
INSERT CALIBRATION activated every hour automaticly by central station		
ACTUAL MONITORING by dB(A) meter reading and by acustical monitoring		
REMOTE CONTROLLABLE FUNCTIONS acustical monitor activated by 3400 Hz control tone		
SIZE 3 x 3 x 1,5 feet	**WEIGHT** 100 lbs	**TEMP RANGE** air conditioned
CONSTRUCTION modular	**POWER REQUIREMENTS** 100 Watt	**TIME OF UNATTENDED OPERATION** unlimited
COMMUNICATION		
PHOTO	**NOTES**	

TRANSMISSION LINK

TYPE
voice grade telephone line

CHANNELS PER SITE
one

PATH LENGTHS
6 - 10 miles

TRANSMISSION POWER LEVEL

FREQUENCY RESPONSE OF CHANNEL
30 - 3400 Hz

DYNAMIC RANGE
50 dB

MODEM
DC - frequency converter

MESSAGE RATE
continous pulse rate

BIT RATE
N A

MESSAGE CONTENT
pulse frequency modulation

ERROR DETECTION
N A

ERROR CORRECTION
N A

MESSAGE FORMAT
N A

CENTRAL DATA PROCESSING AND DISPLAY

TYPE OF PROCESSOR
present: Rohde & Schwarz classifier
future: NOVA 1200 digital computer

SUBSYSTEMS AND EQUIPMENT CONFIGURATION
future:
a) Nova 1200 with 16 K core
b) Alpha numeric terminal to add flight inf. to displayed noise events
c) ASR 33 to print out data and to punch tape for further data processing in large scale computer Siemens 4004

DISPLAYS, ALARMS, MONITORS
present:
a) digital printer for noise events
b) ASR 33 to print hourly L_{eq} value

NO. REMOTE SITES
present: 12
future: 16 (28)

PROVISION FOR NEW SITES
yes

SIZE
2 x 19 inch rack

WEIGHT
200 lbs

POWER
500 Watt

TEMP RANGE
operating room is airconditioned

TIME OF UNATTENDED OPERATION
between 02 - 08 a.m.

LOGS
present:
monthly fleet noise average of A/C type
" " " rank see att. No. 2
monthly L_{eq} diagrams for each MP
see att. No. 3

future:
output of large scale computer
see att. No. 4

PHOTO

NOTES

CENTRAL PROCESSING SOFTWARE

NUMBER WORDS OF PROGRAM ?	NUMBER WORDS OF DATA ?
NUMBER WORDS SPARE ?	PEAK PERCENTAGE UTILIZATION OF COMPUTER ?
METHOD OF LOADING PROGRAM punch tape	PROVISIONS FOR ERROR MESSAGES yes
NUMBER OF OPERATOR INPUTS 15 commands	

under development

TRACKING

TYPE		
RANGE COVERAGE	RANGE ACCURACY	RANGE RATE
BEARING COVERAGE	BEARING ACCURACY	BEARING RATE
ALTITUDE COVERAGE	ALTITUDE ACCURACY	ALTITUDE RATE
NUMBER TRACKING SITES	LOCATION	
ACTIVE/PASSIVE TARGETS	TRANSPONDER OR BEACON	
ANALOG/DIGITAL RECORDING OF DATA	REAL TIME PLOT OF TARGET	PLOT SCALE
RECORDED DATA ACCURACY	OFF LINE PROCESSING TURNAROUND TIME	PLOT ACCURACY
PROCESSED PLOT OF TARGET	PROCESSED PLOT SCALE	PROCESSED ACCURACY
LINE PRINTER PARAMETERS LISTED		
RATE PARAMETERS ARE LISTED ON LINE PRINTER		

PHOTO	NOTES planned for future

SYSTEM COST/SCHEDULE

DESIGN COST	DESIGN MAN-MONTHS	DESIGN PERIOD
PROCUREMENT COST	PROCUREMENT MAN-MONTHS	PROCUREMENT PERIOD
SYSTEM COST INSTALLED	MANUFACTURE MAN-MONTHS	MANUFACTURE PERIOD

YEARLY MAINTENANCE COST present: 3 000 $ future: 7 000 $	RENTAL/LEASE COST PER YEAR
OPERATIONS COST present: 40 000 $ future: 75 000 $	LIFE EXPECTANCY 8 - 10 yrs
CURRENT REPLACEMENT COST	

PERSONNEL REQUIREMENTS IN NUMBER PEOPLE AND MAN-HOURS PER YEAR

present:

MAINTENANCE 1/4 MAN-HOURS 400

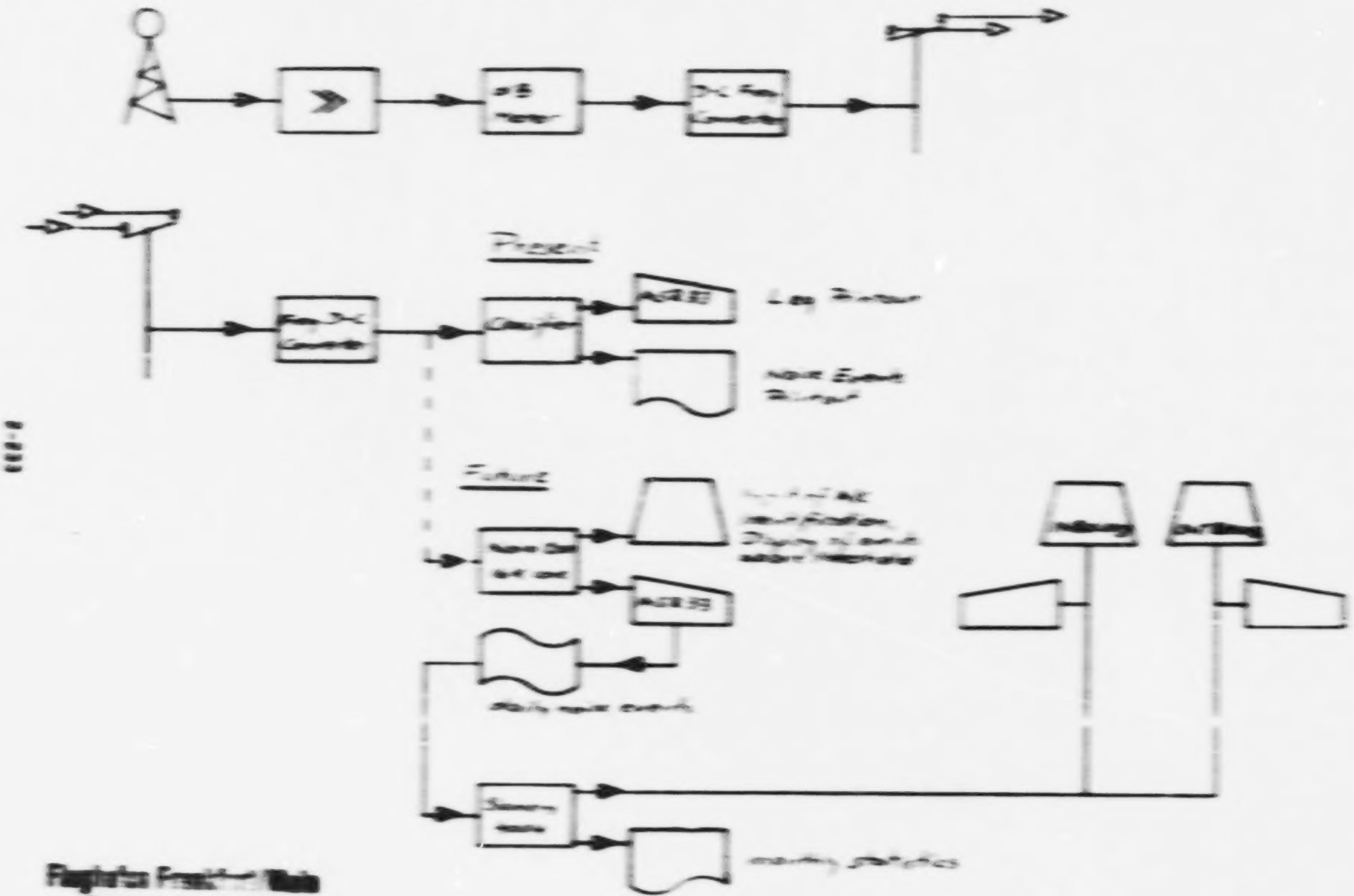
OPERATION 2 MAN-HOURS 3200

DATA REVIEW 1 MAN-HOURS 1600

future:

Maintenance:	1/2	M. hrs.	800
Operation:	4	"	6400
Data Review:	1	"	1600

Overall Block Diagram

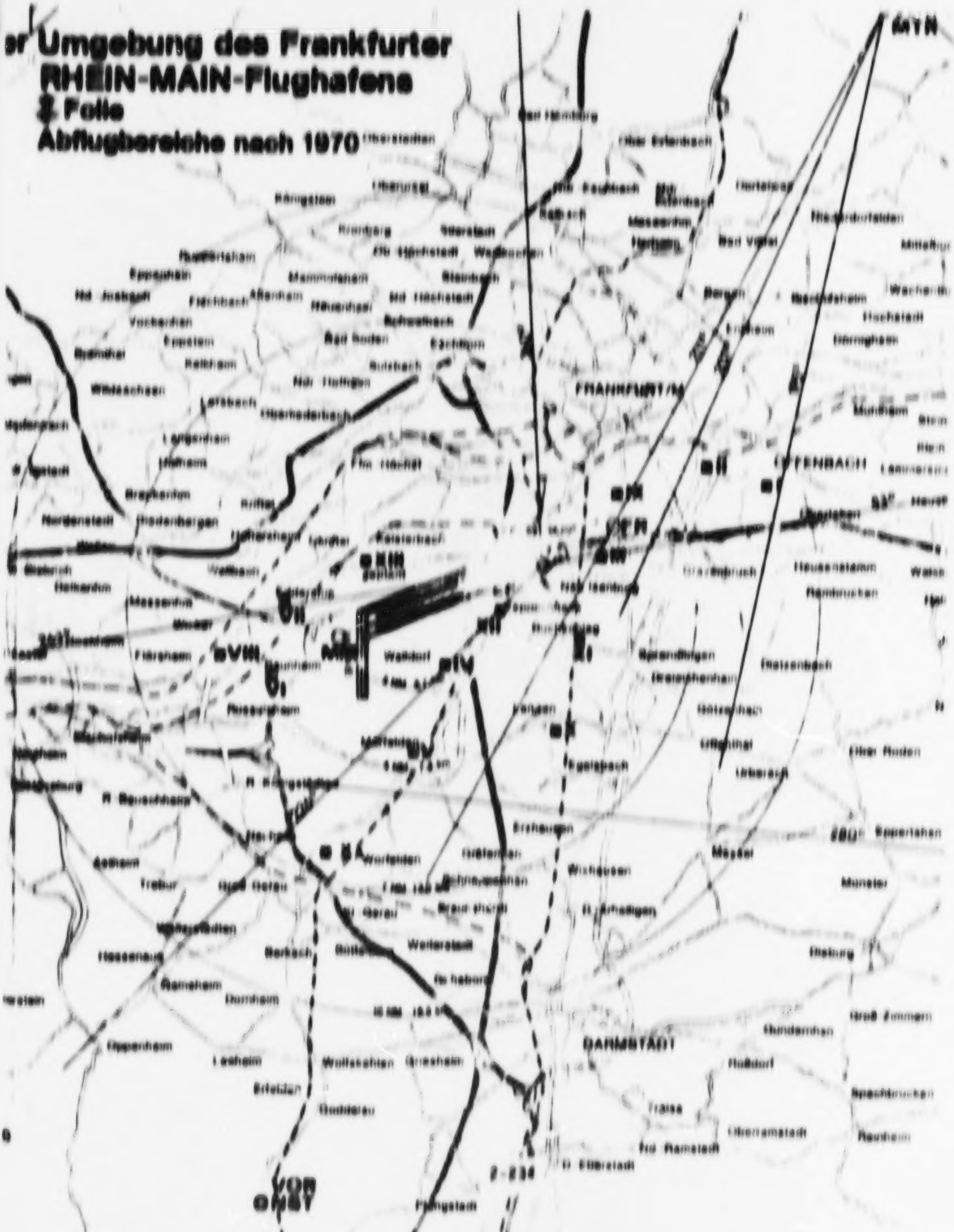

Present
ASR 33
Log Printout
Noise Event Printout
Future
ASR 33
monthly statistics

Flughafen Frankfurt/Main
Aktiengesellschaft

er Umgebung des Frankfurter RHEIN-MAIN-Flughafens

2. Folie

Abflugbereiche nach 1970



MTN
Bad Homburg
Oberstedten
Ober Erlenbach
Oberursel
Königstein
Bad Vilbel
Kronberg
Steinbach
Bergen
Enkheim
Hochstadt
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Offenthal
Heusenstamm
Neu Isenburg
Sprendlingen
Dreieichenhain
Langen
Egelsbach
Erzhausen
Walldorf
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Kelsterbach
Raunheim
Rüsselsheim
Flörsheim
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Hattersheim
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Eppstein
Wiesbaden
Nordenstadt
Bischofsheim
Ginsheim
Trebur
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Worfelden
Weiterstadt
Gräfenhausen
Wixhausen
Arheilgen
DARMSTADT
Griesheim
Wolfskehlen
Gernsheim
Stockstadt
Goddelau
Erfelden
Leeheim
Oppenheim
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Groß Zimmern
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Rodgau
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Nd Ramstadt
Pfungstadt
Büttelborn
Berkach
Rembrücken
OFFENBACH
Lämmerspiel
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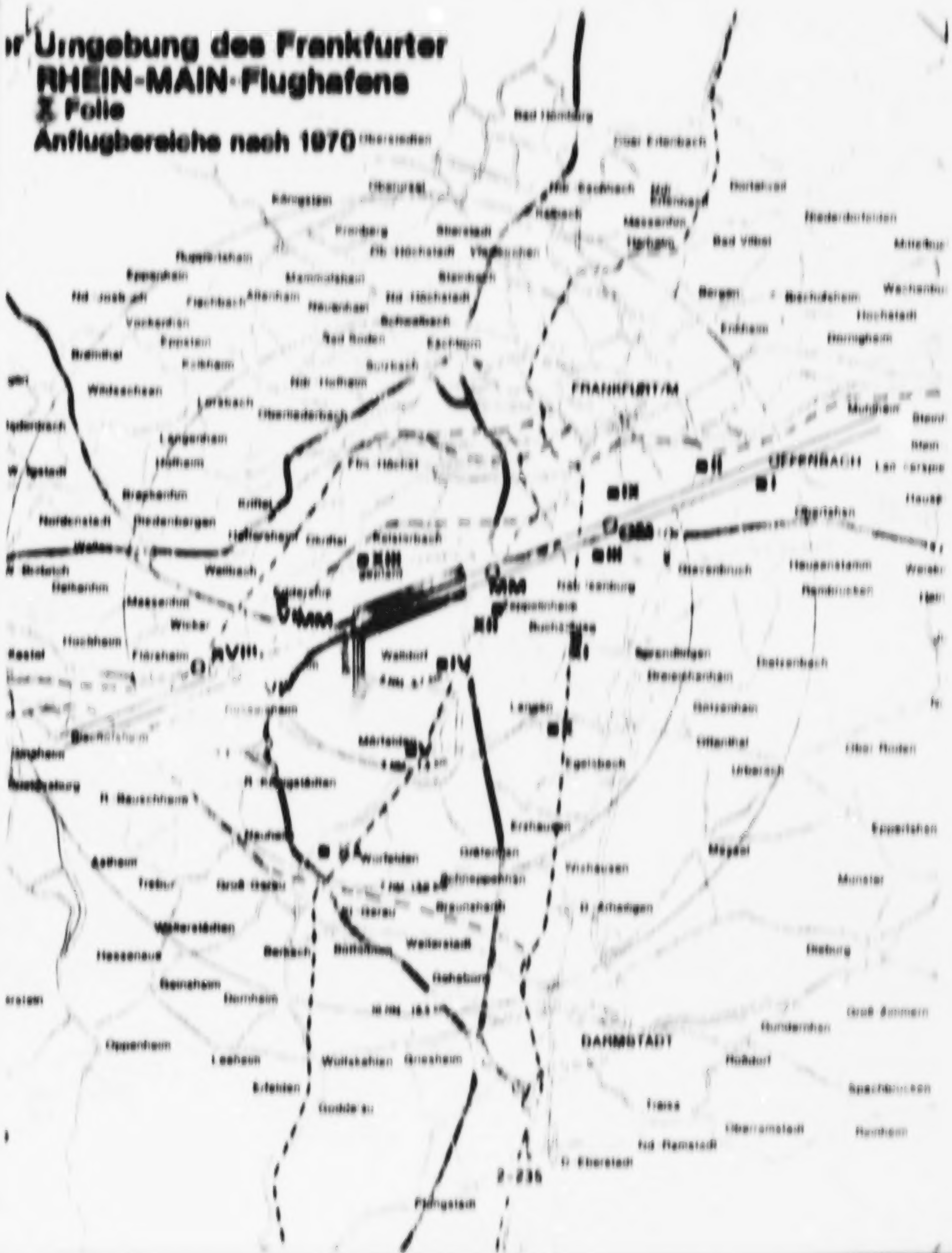
2. Folie
Anflugbereiche nach 1970



Oberstedten
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Ffm. Höchst
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Breckenheim
Kriftel
Nordenstadt
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Hattersheim
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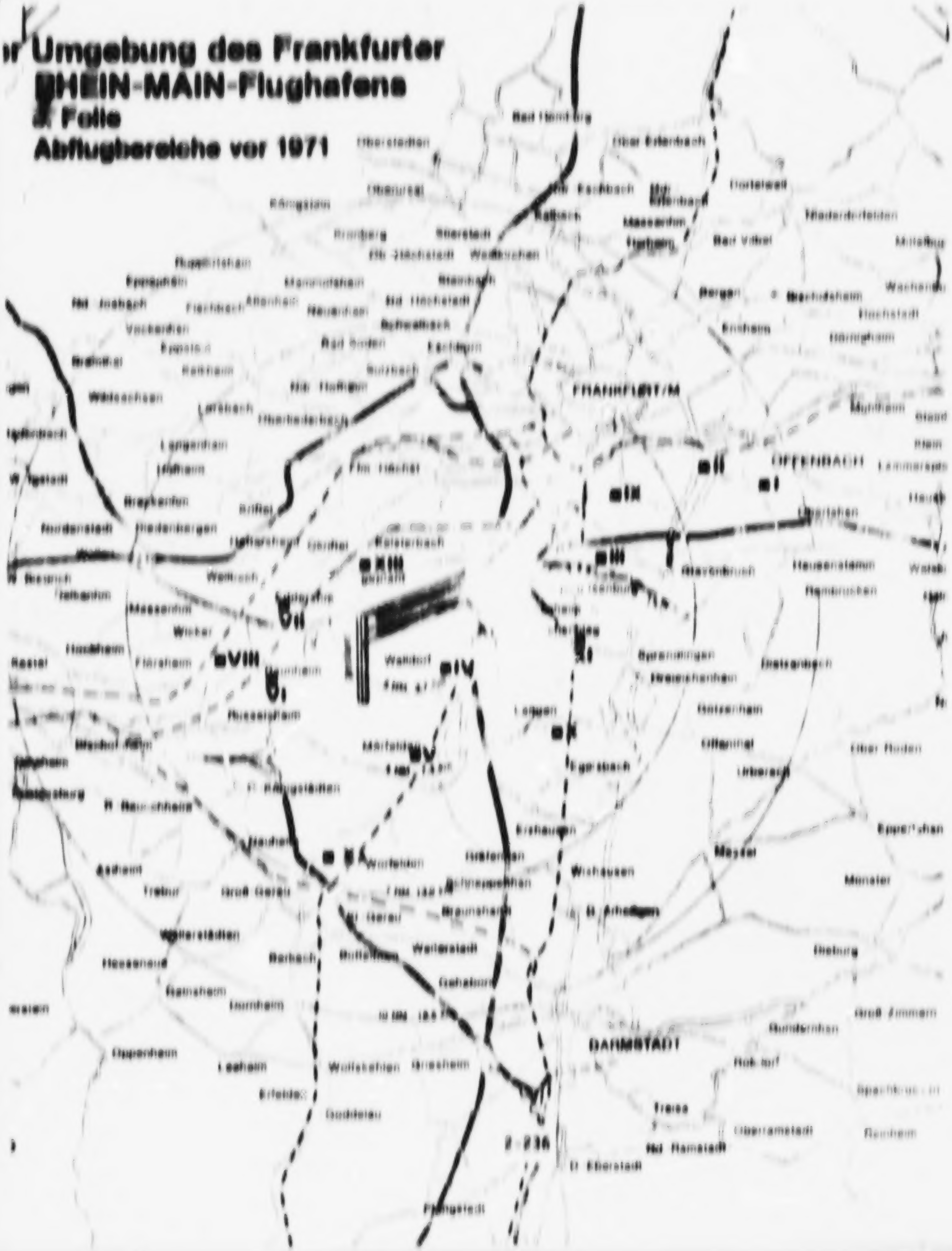
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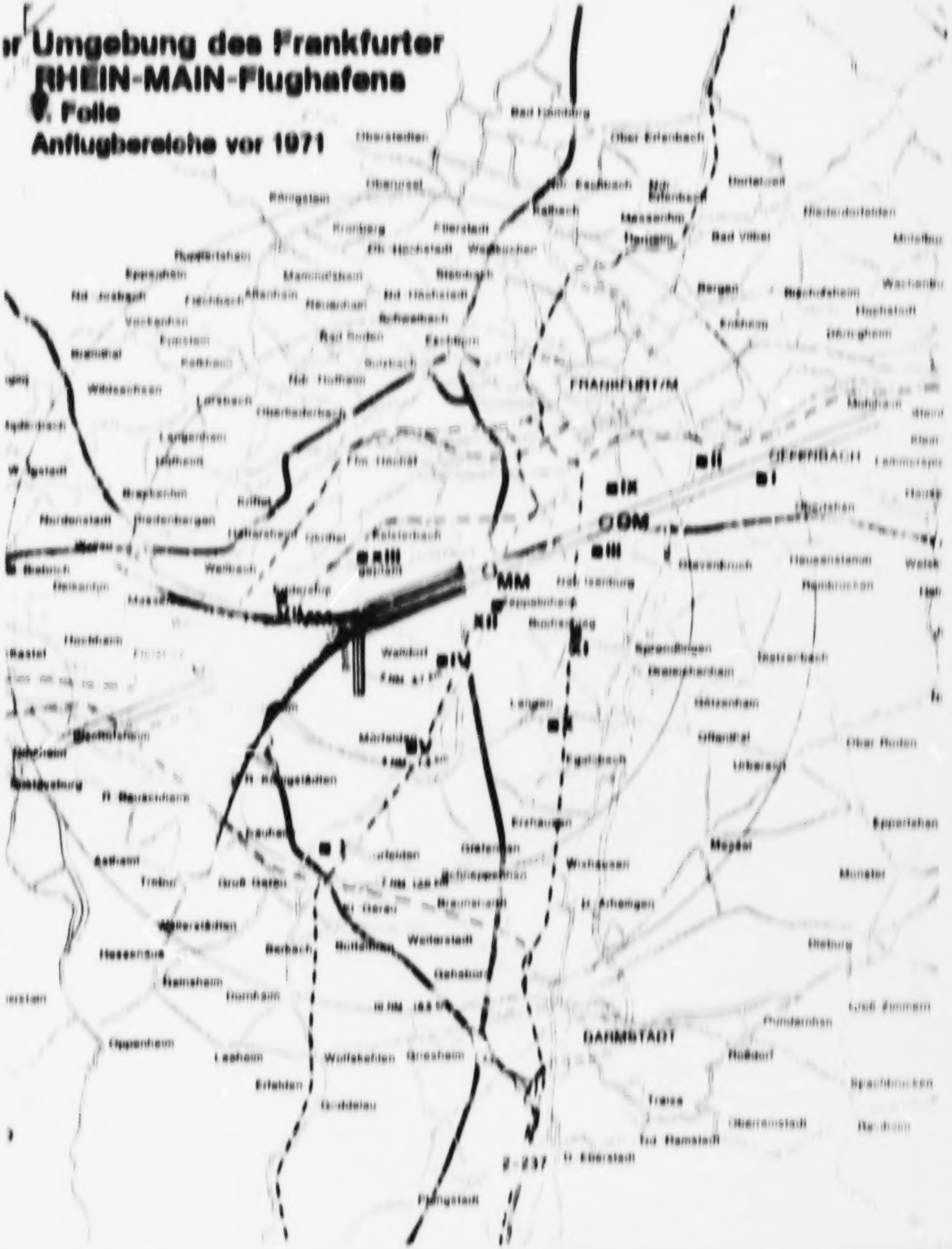
Anflugbereiche vor 1971



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Nr. 8

FLUGHAFEN FRANKFURT/MAIN AG
Öffentlichkeit und Umwelt

NOISE REPORT

Fleet Noise Level Report - FNLR -

Ref.: Approaches on RWY 25

The reduction of aircraft noise is a mutual task of all who are concerned. In Frankfurt there is a major problem in the approach sector especially during landings on runways 25. The cooperation of airlines and ATC led in the past to improvements in the departure area. Now measures have to be taken to amend the approach situation equally successful.

We know that meteorological conditions influence sound waves to a great extent. For this reason a differentiation is made as far as the weather situation is concerned. There are 8 weather categories. For reasons of a continuous statistics this report shows the results of one category from which we assume that it occurs constantly and covers a great number of approaches on RWY 25. Therefore you will find only a (great) share of all approaches. But all of them took place during nearly the same weather conditions. Simultaneous there is an accumulation which shows the final rank of each airline within a half years period. This statistics will inform you about the noise measured at the monitoring points Offenbach (I), (II), Neu-Isenburg (III) and F.-Lerchesberg (IX), whenever 72 dB(A) for more than one second are exceeded and an unobjectionable identification can be certified.

For assessment the "Effective duration" of the noise is used. This is a measurement which integrates level and duration of an event. The units are so-called effective duration seconds (W_s). The W_s are a simplification of the international used "Effective Perceived Noise Level" (EPNL). It is, however, without a tone correction and based on dB(A).

The W_s in our case have to be related to a level of 78 dB(A), that means the annoyance of the representative event equals a noise with a level of 78 dB(A) and with a duration of X seconds. With other words we use the level/duration equivalence law which expresses the same annoyance of

	40 s with a level of	74 dB(A)	≙	20 W_s	with a level of	78 dB(A)
or	10 s	82 dB(A)	≙	20 W_s		78 dB(A)
or	5 s	86 dB(A)	≙	20 W_s		78 dB(A)

The advantage of this method is that level as well as duration of a noise is taken into consideration.

It is our opinion that it is not possible to assess neither a given noise situation nor a pilot on account of a single event. For this reason we show in our statistics not single occurances, but single fleets in relation to a representative average. This average results from all approaches in one category. The values of all categories you will find on page 4. If an airline has less than 10 approaches in this particular category it might be able to influence the noise tendency of all approaches but it is not considered.

Judgement

The best results are achieved with less than 5 W_a (≤ 5). Related to the average of each category we distinguish between four groups of fleets

1.	quiet approaching fleet	continue your procedure
2.	average	compare your approach with the procedure suggested by the group of experts - contact Mr. Hasenbein *) occasionally, dial ext. 3240
3.	noisy approaching fleet	improvements of your approach is urgently suggested - contact Mr. Hasenbein now
4.	very noisy approaching fleet	more than 4 times the average value is absolutely avoidable - now Mr. Hasenbein will contact you.

If a single occurance reaches more than 4 times the effective duration value of the average in column 7 you will find it on page 4. If there are no special reasons, it is likely that avoidable noise occured. On request we would like to inform you daily about those approaches of the previous day.

We hope that further efforts bring about the same successful improvements at the approach as it was in the departing area. Further more we hope that on account of these amendments decisive restrictions can be avoided.

Flughafen
Frankfurt/Main AG
Öffentlichkeit und Umwelt

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*) Mr. Hasenbein is Lärmschutz-Beauftragter des Hessischen Ministers für Wirtschaft und Technik

relative humidity > 60 %
temperature 0-20°C
headwind

FNLR 707

judgement of approach	March 1974			Accumulation from November 1974		
	airline	number of approaches on RWY 25	W_s per approach	airline	number of approaches on RWY 25	W_s per approach
1	2	3	4	5	6	7
quiet approaching fleet	PA	23	10	BG	42	9
				LH	475	9
				DF	46	10
average	LH	56	11	TW	104	11
noisy approaching fleet	TW	41	14	PA	258	12
				IR	46	12
				LY	19	13
				SQ	24	14
				LA	16	15
				ET	13	15
				PK	23	15
				TP	12	18
				TL	48	18
				SV	14	18
				SN	14	18
				AF	17	20
				KU	29	22
				AV	14	22
				MS	35	23
				AI	22	24
				AP	26	26
total number of approaches of this type of aircraft and average W_s					1398	11

Excessive noise events during this report period

at	airline	flight No.	landing time (GMT)	maximum level at measuring point I	II	III	IX	category No.	W_s
2.3.	TW	756	10.15	78	86	-	-	50	64
5.3.	LA	170	16.11	82	82	-	-	40	54
12.3.	TR	722	11.13	-	86	-	-	40	49
13.3.	LH	601	11.23	78	86	-	-	50	57
13.3.	TL	128	15.27	78	86	-	-	40	62
16.3.	DF	511	04.55	82	82	-	-	40	73
16.3.	AY	070	17.15	74	86	-	-	50	53
17.3.	TW	702	21.25	78	90	-	-	50	83
20.3.	SN	721	07.58	86	78	74	-	40	54
24.3.	TW	602	16.26	74	82	-	-	40	33
24.3.	TW	8900	21.05	86	-	-	-	40	35
26.3.	IR	752	17.35	74	82	-	-	10	25
27.3.	PK	713	08.13	74	90	-	-	40	67
27.3.	TW	8620	22.08	82	82	-	-	10	27
29.3.	TW	267	06.34	78	86	74	-	40	39
29.3.	AF	675	06.37	78	86	-	-	40	39

WEATHER CATEGORIES

Description		No.	average W_s
relative humidity temperature tailwind	<60 % 0 - 20° C	10	5
relative humidity temperature tailwind	<60 % ~~>20° C~~ < 0° C	13	-
relative humidity temperature headwind	<60 % 0 - 20° C	20	8
relative humidity temperature headwind	<60 % ~~>20° C~~ < 0° C	23	-
relative humidity temperature tailwind	>60 % 0 - 20° C	40	8
relative humidity temperature tailwind	>60 % ~~>20° C~~ < 0° C	43	< 5
relative humidity temperature headwind	>60 % 0 - 20° C	50	11
relative humidity temperature headwind	>60 % ~~>20° C~~ < 0° C	53	5

FNLR 720

relative humidity > 60 %
temperature 0-20°C
headwind

judgement of approach	March 1974			Accumulation from November 1973		
	airline	number of approaches on RWY 25	W_a per approach	airline	number of approaches on RWY 25	W_a per approach
1	2	3	4	5	6	7
quiet approaching fleet				LY PG	14 14	6,5 6
noisy approaching fleet				KJ ET ME	18 10 62	9 10 10
total number of approaches of this type of aircraft and average W_a					114	7

Excessive noise events during this report period

at	airline	flight No.	landing time (GMT)	maximum level at measuring point I	II	III	IX	category No.	W_s
19.1.	KL	122	18.22	74	86	-	-	50	40

WEATHER CATEGORIES

Description		No.	average W_s
relative humidity temperature tailwind	<60 % 0 - 20° C	10	-
relative humidity temperature tailwind	< 60 % ~~>20° C~~ < 0° C	13	-
relative humidity temperature headwind	<60 % 0 - 20° C	20	<5
relative humidity temperature headwind	<60 % ~~>20° C~~ < 0° C	23	-
relative humidity temperature tailwind	>60 % 0 - 20° C	40	6
relative humidity temperature tailwind	>60 % ~~>20° C~~ < 0° C	43	-
relative humidity temperature headwind	>60 % 0 - 20° C	50	7
relative humidity temperature headwind	>60 % ~~>20° C~~ < 0° C	53	-

FNLR ...727...

relative humidity > 60 %
temperature 5-20°C
headwind

judgement of approach	March 1974			Accumulation from November 1973		
	airline	number of approaches on RWY 25	w_s per approach	airline	number of approaches on RWY 25	w_s per approach
1	2	3	4	5	6	7
quiet approaching fleet	LH PA DF IB	403 63 23 14	< 5	FG LH PA DF IB IR TU SN AF TP OA	10 2838 526 155 111 39 11 14 50 45 66	< 5
total number of approaches of this type of aircraft and average W_s					3867	< 5

Excessive noise events during this report period

at	airline	flight No.	landing time (GMT)	maximum level at measuring point I	II	III	IV	category No.	W_s
16.1.	LH	4061	07.23	-	82	-	-	50	26
29.1.	LH	721	11.31	86	74	-	-	50	34

WEATHER CATEGORIES

Description		No.	average W_s
relative humidity temperature tailwind	<60 % 0 - 20° C	10	< 5
relative humidity temperature tailwind	< 60 % ~~>20° C~~ < 0° C	13	
relative humidity temperature headwind	<60 % 0 - 20° C	20	
relative humidity temperature headwind	<60 % ~~>20° C~~ < 0° C	23	
relative humidity temperature tailwind	>60 % 0 - 20° C	40	
relative humidity temperature tailwind	>60 % ~~>20° C~~ < 0° C	43	
relative humidity temperature headwind	>60 % 0 - 20° C	50	
relative humidity temperature headwind	>60 % ~~>20° C~~ < 0° C	53	

relative humidity ≥ 60 %
temperature 0-20°C
headwind

FNLR 727.....

judgement of approach	March 1974			Accumulation from November 1973		
	airline	number of approaches on RWY 25	V_s per approach	airline	number of approaches on RWY 25	V_s per approach
1	2	3	4	5	6	7
quiet approaching fleet	LH	307	≤5	LH EI RY	2178 25 12	≤5
total number of approaches of this type of aircraft and average V_s					2222	≤5

Excessive noise events during this report period

nr	airline	flight No.	landing time (GMT)	maximum level at measuring point I	II	III	IX	category No.	W_s

WEATHER CATEGORIES

Description		No.	average W_s
relative humidity temperature tailwind	<60 % 0 - 20° C	10	<5
relative humidity temperature tailwind	<60 % ~~>20° C~~ <0° C	13	
relative humidity temperature headwind	<60 % 0 - 20° C	26	
relative humidity temperature headwind	<60 % ~~>20° C~~ <0° C	23	
relative humidity temperature tailwind	>60 % 0 - 20° C	40	
relative humidity temperature tailwind	>60 % ~~>20° C~~ <0° C	43	
relative humidity temperature headwind	>60 % 0 - 20° C	50	
relative humidity temperature headwind	>60 % ~~>20° C~~ <0 °C	53	

FNLR 747

relative humidity ≥ 60 %
temperature 0-20°C
headwind

Judgement of approach	March 1974			Accumulation from November 1973		
	airline	number of approaches on RWY 25	W_s per approach	airline	number of approaches on RWY 25	W_s per approach
1	2	3	4	5	6	7
quiet approaching fleet	LH	26	≤ 5	JL	14	5
	PA	41		DF	14	5
				SA	31	5
				LH	180	5
average				SQ	10	6
noisy approaching fleet				BA	13	7
				PA	180	7
				AI	61	7
				KL	14	8
				QF	25	12
				TW	40	17
total number of approaches of this type of aircraft and average W_s					567	8

Excessive noise events during this report period

at	airline	flight No.	landing time (GMT)	maximum level at measuring point I	II	III	IX	category No.	W_s
2.1.	TW	740	07.55	74	82	-	-	50	29
3.1.	TW	740	07.23	74	82	-	-	43	26
11.1.	AI	116	12.35	82	78	-	-	40	39
16.1.	QF	940	19.04	74	82	-	-	50	29
17.1.	PA	72	06.41	-	82	-	-	50	24
19.1.	LH	463	21.46	-	82	-	-	40	26
20.1.	JF	733	04.58	-	82	-	-	40	30
20.1.	AI	105	05.35	-	82	-	-	40	24
20.1.	LH	401	05.53	78	82	-	-	40	34
21.1.	TW	740	07.25	82	74	74	-	40	33
26.1.	BA	823	05.31	-	82	-	-	40	21

WEATHER CATEGORIES

Description		No.	average W_s
relative humidity temperature tailwind	< 60 % 0 - 20° C	10	-
relative humidity temperature tailwind	< 60 % ~~≥20° C~~ < 0° C	13	-
relative humidity temperature headwind	< 60 % 0 - 20° C	20	5
relative humidity temperature headwind	< 60 % ~~≥20° C~~ < 0° C	23	-
relative humidity temperature tailwind	>60 % 0 - 20° C	40	5
relative humidity temperature tailwind	>60 % ~~≥20° C~~ < 0° C	43	< 5
relative humidity temperature headwind	>60 % 0 - 20° C	50	6
relative humidity temperature headwind	>60 % ~~≥20° C~~ < 0° C	53	< 5

FNLR DC-8

relative humidity > 60 %
temperature 0-20°C
headwind

judgement of approach	March 1974			Accumulation from November 1973		
	airline	number of approaches on RWY 25	W_s per approach	airline	number of approaches on RWY 25	W_s per approach
1	2	3	4	5	6	7
quiet approaching fleet				SR TO AZ SK	20 15 19 31	≤ 5 ≤ 5 ≤ 5 8
average	SR	10	9	KL PR SR	31 31 130	9 9 9
noisy approaching fleet	AC	14	21	GA OV CL AC	16 46 38 112	10 11 13 17
total number of approaches of this type of aircraft and average W_s					513	9

Excessive noise events during this report period

at	airline	flight No.	landing time (GMT)	maximum level at measuring point I	II	III	IX	category No.	W_s
1. 3.	AC	874	09.00	86	78	-	-	40	57
2. 3.	AC	806	11.11	82	78	-	-	50	43
3. 3.	AC	592	10.04	74	86	-	-	40	52
15. 3.	AC	874	09.31	86	78	74	-	50	73
16. 3.	AC	806	10.18	82	78	74	-	50	51
17. 3.	CV	813	07.43	74	82	-	-	50	40
17. 3.	AC	592	19.38	74	82	-	-	50	45
20. 3.	AC	806	09.45	78	82	-	-	40	38
20. 3.	VA	730	14.02	-	86	-	-	40	34
21. 3.	OB	853	04.13	78	78	-	-	40	34
24. 3.	AC	874	09.57	-	86	-	-	40	60
26. 3.	AC	872	07.31	82	82	-	-	40	53

WEATHER CATEGORIES

Description		No.	average W_s
relative humidity temperature tailwind	<60 % 0 - 20° C	10	< 5
relative humidity temperature tailwind	< 60 % ~~>20° C~~ < 0° C	13	-
relative humidity temperature headwind	<60 % 0 - 20° C	20	7
relative humidity temperature headwind	<60 % ~~>20° C~~ < 0° C	23	-
relative humidity temperature tailwind	>60 % 0 - 20° C	40	7
relative humidity temperature tailwind	>60 % ~~>20° C~~ < 0° C	43	< 5
relative humidity temperature headwind	>60 % 0 - 20° C	50	9
relative humidity temperature headwind	>60 % ~~>20° C~~ < 0° C	53	< 5

relative humidity ≥ 60 %
temperature 0-20°C
headwind

FNLR DC-9

	March 1974			Accumulation from Nov. 73		
judgement of approach	airline	number of approaches [illegible]	W_B per approach	airline	number of approaches [illegible]	W_B per approach
1	2	3	4	5	6	7
quiet approaching fleet	SR JP SK OS AZ KL	5 14 28 19 16 19	< 5	JU SR LS SK AY IB AZ OS JP KL	16 184 68 195 66 73 229 205 114 164	< 5
total number of approaches of this type of aircraft and average W_B					1314	< 5

Excessive noise events during this report period

at	airline	flight No.	landing time (GMT)	maximum level at measuring point I	II	III	IV	category No.	Wₛ
1.2.	KL	0.15	04.02	74	82	-	-	43	22
12.3.	KL	245	16.33	-	76	-	-	40	26
12.3.	OS	405	19.04	-	82	-	-	40	25

WEATHER CATEGORIES

Description		No.	average Wₛ
relative humidity temperature tailwind	< 60 % 0 - 20° C	10	< 5
relative humidity temperature tailwind	< 60 % ~~20° C~~ < 0° C	13	
relative humidity temperature headwind	< 60 % 0 - 20° C	20	
relative humidity temperature headwind	< 60 % ~~20° C~~ < 0° C	23	
relative humidity temperature tailwind	> 60 % 0 - 20° C	40	
relative humidity temperature tailwind	> 60 % ~~20° C~~ < 0° C	43	
relative humidity temperature headwind	> 60 % 0 - 20° C	50	
relative humidity temperature headwind	> 60 % ~~20° C~~ < 0° C	53	

FNLR DC 10

relative humidity ≥ 60 %
temperature 0-20°C
headwind

judgement of approach	March 1974			Accumulation from November 1973		
	airline	number of approaches on rwy 25	W_s per approach	airline	number of approaches on rwy 25	W_s per approach
1	2	3	4	5	6	7
quiet approaching fleet				TK GA	75 14	} ≤ 5
noisy approaching fleet				KL	10	6
total number of approaches of this type of aircraft and average W_s					113	≤ 5

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Excessive noise events during this report period

at	airline	flight No.	landing time (GMT)	maximum level at measuring point				category No.	W_s
				I	II	III	IV		

WEATHER CATEGORIES

Description		No.	average W_s
relative humidity temperature tailwind	< 60 % 0 - 20° C	32	< 5
relative humidity temperature tailwind	< 60 % ~~20° C~~ < 0° C	13	
relative humidity temperature headwind	< 60 % 0 - 20° C	26	
relative humidity temperature headwind	< 60 % ~~20° C~~ < 0° C	23	
relative humidity temperature tailwind	> 60 % 0 - 20° C	46	
relative humidity temperature tailwind	> 60 % ~~20° C~~ < 0° C	42	
relative humidity temperature headwind	> 60 % 0 - 20° C	58	
relative humidity temperature headwind	> 60 % ~~20° C~~ < 0° C	53	

FNLR I-5

relative humidity > 60 %
temperature 0-20°C
headwind

judgement of approach	March 1974			Accumulation from November 1973		
	airline	number of approaches on RWY 25	e_s per approach	airline	number of approaches on RWY 25	e_s per approach
1	2	3	4	5	6	7
quiet approaching fleet						
very noisy approaching fleet	USAF	10	126	USAF	28	105
total number of approaches of this type of aircraft and average W_s					28	105

Excessive noise events during this report period

at	airline	flight No.	landing time (GMT)	maximum level at measuring point I	II	III	IV	category No.	W_s

WEATHER CATEGORIES

Description		No.	average W_s
relative humidity temperature tailwind	< 60 % 0 - 20° C	10	-
relative humidity temperature tailwind	< 60 % ~~> 20° C~~ < 0° C	13	-
relative humidity temperature headwind	< 60 % 0 - 20° C	20	-
relative humidity temperature headwind	< 60 % ~~> 20° C~~ < 0° C	23	-
relative humidity temperature tailwind	> 60 % 0 - 20° C	40	75
relative humidity temperature tailwind	> 60 % ~~> 20° C~~ < 0° C	43	-
relative humidity temperature headwind	> 60 % 0 - 20° C	50	105
relative humidity temperature headwind	> 60 % ~~> 20° C~~ < 0° C	53	-

FNLR C-141

relative humidity ≥ 60 %
temperature 0-20°C
headwind

	March 1974			Accumulation from November 1973		
judgement of approach	airline	number of approaches on RWY 25	w_s per approach	airline	number of approaches on RWY 25	w_s per approach
1	2	3	4	5	6	7
quiet approaching fleet						
average				USAF	236	10
noisy approaching fleet	USAF	10	11			
total number of approaches of this type of aircraft and average W_s					236	10

2-258

FNLR CV-990

relative humidity [illegible]
temperature [illegible]
headwind

[illegible]	March 1974			Accumulation from November 1973		
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	2	3	4	5	6	7
quiet						
approaching						
fleet				58	51	[illegible]
total number of approaches of this type of aircraft and average W_a					56	[illegible]

Excessive noise events during this report period

at	airline	flight No.	landing time (GMT)	maximum level at measuring point I	II	III	IV	category No.	W_s

WEATHER CATEGORIES

Description		No.	average W_s
relative humidity temperature tailwind	< 60 % 0 - 20° C	10	< 5
relative humidity temperature tailwind	< 60 % ~~> 20° C~~ < 0° C	13	
relative humidity temperature headwind	< 60 % 0 - 20° C	20	
relative humidity temperature headwind	< 60 % ~~> 20° C~~ < 0° C	23	
relative humidity temperature tailwind	> 60 % 0 - 20° C	40	
relative humidity temperature tailwind	> 60 % ~~> 20° C~~ < 0° C	43	
relative humidity temperature headwind	> 60 % 0 - 20° C	50	
relative humidity temperature headwind	> 60 % ~~> 20° C~~ < 0° C	53	

FNLA VC-10/15

relative humidity ≥ 60 %
temperature 0-20°C
headwind

judgement of approach	March 1974 airline	March 1974 number of approaches on day 75	March 1974 W_a per approach	Accumulation from November 1973 airline	Accumulation from November 1973 number of approaches on day 75	Accumulation from November 1973 W_a per approach
1	2	3	4	5	6	7
quiet approaching fleet						
average				EC	11	18
noisy approaching fleet				BA	21	14
total number of approaches of this type of aircraft and average W_a					[illegible]	18

Excessive noise events during this report period

at	airline	flight No.	landing time (GMT)	maximum level at measuring point I	II	III	IX	category No.	W_s

WEATHER CATEGORIES

Description		No.	average W_s
relative humidity temperature tailwind	< 60 % 0 - 20° C	18	-
relative humidity temperature tailwind	< 60 % ~~> 20° C~~ < 0° C	13	-
relative humidity temperature headwind	< 60 % 0 - 20° C	20	-
relative humidity temperature headwind	< 60 % ~~> 20° C~~ < 0° C	23	-
relative humidity temperature tailwind	> 60 % 0 - 20° C	40	13
relative humidity temperature tailwind	> 60 % ~~> 20° C~~ < 0° C	43	-
relative humidity temperature headwind	> 60 % 0 - 20° C	50	38
relative humidity temperature headwind	> 60 % ~~> 20° C~~ < 0° C	53	-

FNLR II,62

relative humidity ≥ 60 %
temperature 0-20°C
headwind

Judgement of approach	March 1974			Accumulation from November 1973		
	airline	number of approaches on RWY 25	W_a per approach	airline	number of approaches on RWY 25	W_a per approach
1	2	3	4	5	6	7
quiet approaching fleet				50	13	< 1
total number of approaches of this type of aircraft and average W_a					13	< 1

Excessive noise events during this report period

at	airline	flight No.	landing time (GMT)	maximum level at measuring point I	II	III	IV	category No.	W_s
19.1.	SU	259	08.11	-	82	-	-	50	23

WEATHER CATEGORIES

Description		No.	average W_s
relative humidity temperature tailwind	<60 % 0 - 20° C	10	< 5
relative humidity temperature tailwind	< 60 % ~~20° C~~ < 0° C	13	
relative humidity temperature headwind	<60 % 0 - 20° C	20	
relative humidity temperature headwind	<60 % ~~>20° C~~ < 0° C	23	
relative humidity temperature tailwind	>60 % 0 - 20° C	40	
relative humidity temperature tailwind	>60 % ~~20° C~~ < 0° C	43	
relative humidity temperature headwind	>60 % 0 - 20° C	50	
relative humidity temperature headwind	>60 % ~~20° C~~ < 0° C	53	

FNLR H5-21

relative humidity > 60 %
temperature 0-20°C
headwind

judgement of approach	March 1974			Accumulation from November 1973		
	airline	number of approaches on RWY 25	x_s per approach	airline	number of approaches on RWY 25	x_s per approach
1	2	3	4	5	6	7
quiet approaching fleet	BE	13	11	IA CY	16 11	12 19
noisy approaching fleet				BE	136	24
total number of approaches of this type of aircraft and average x_s	[illegible]				[illegible]	

Excessive noise events during this report period

at	airline	flight No.	landing time (GMT)	maximum level at measuring point I	II	III	IV	category No.	W_s

WEATHER CATEGORIES

Description		No.	average W_s
relative humidity temperature tailwind	<60 % 0 - 20° C	18	-
relative humidity temperature tailwind	<60 % ~~>20° C~~ < 0° C	13	-
relative humidity temperature headwind	<60 % 0 - 20° C	20	23
relative humidity temperature headwind	<60 % ~~>20° C~~ < 0° C	23	-
relative humidity temperature tailwind	>60 % 0 - 20° C	48	12
relative humidity temperature tailwind	>60 % ~~>20° C~~ < 0° C	43	22
relative humidity temperature headwind	>60 % 0 - 20° C	58	21
relative humidity temperature headwind	>60 % ~~>20° C~~ < 0° C	53	22

relative humidity ≥ 60 %
temperature 0-20°C
headwind

judgement of approach	March 1974			accumulation from November 1973		
	airline	number of approaches on RWY 25	e_s per approach	airline	number of approaches on RWY 25	e_s per approach
1	2	3	4	5	6	7
quiet approaching fleet	BE	58	< 5	BO DV BE BV	14 63 493 47	< 5
total number of approaches of this type of aircraft and average e_s					619	< 5

Excessive noise events during this report period

at	airline	flight No.	landing time (GMT)	maximum level at measuring point I	II	III	IV	category No.	W_s
27.3.	SE	1839	08.17	-	86	-	-	48	21

WEATHER CATEGORIES

Description		No.	average W_s
relative humidity temperature tailwind	< 60 % 0 - 20° C	38	< 5
relative humidity temperature tailwind	< 60 % ~~> 20° C~~ < 0° C	13	
relative humidity temperature headwind	< 60 % 0 - 20° C	28	
relative humidity temperature headwind	< 60 % ~~> 20° C~~ < 0° C	23	
relative humidity temperature tailwind	> 60 % 0 - 20° C	48	
relative humidity temperature tailwind	> 60 % ~~> 20° C~~ < 0° C	43	
relative humidity temperature headwind	> 60 % 0 - 20° C	58	
relative humidity temperature headwind	> 60 % ~~> 20° C~~ < 0° C	53	

PNLR ≥ 210

relative humidity ≥ 60 %
temperature 0-20°C
headwind

judgement of approach	March 1974			Accumulation from November 1973		
	airline	number of approaches on RWY 25	W_a per approach	airline	number of approaches on RWY 25	W_a per approach
1	2	3	4	5	6	7
quiet approaching fleet	AF	17	≤ 5	AY AP AT TU	10 151 12 22	≤ 5
noisy approaching fleet				SN	54	6
total number of approaches of this type of aircraft and average W_a			2-269		331	≤ 5

Excessive noise events during this report period

at	airline	flight No.	landing time (GMT)	maximum level at measuring point I	II	III	IV	category No.	W_s
16.1	SN	721	08.06	82	82	-	-	58	76

WEATHER CATEGORIES

Description		No.	average W_s
relative humidity temperature tailwind	<60 % 0 - 20° C	18	<5
relative humidity temperature tailwind	<60 % ~~>20° C~~ < 0° C	13	
relative humidity temperature headwind	<60 % 0 - 20° C	28	
relative humidity temperature headwind	<60 % ~~>20° C~~ < 0° C	23	
relative humidity temperature tailwind	>60 % 0 - 20° C	48	
relative humidity temperature tailwind	>60 % ~~>20° C~~ < 0° C	43	
relative humidity temperature headwind	>60 % 0 - 20° C	58	
relative humidity temperature headwind	>60 % ~~>20° C~~ < 0° C	53	

relative humidity > 60 %
temperature 0-20°C
headwind

FNLR FK-28

	March 1974			Accumulation from November 1973		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	2	3	4	5	6	7
quiet approaching fleet	DV	12	≤ 5	DV	67	≤ 5
total number of approaches of this type of aircraft and average W_a					71	≤ 5

Excessive noise events during this report period

at	airline	flight No.	landing time (GMT)	maximum level at measuring point I	II	III	IV	category No.	W_s

WEATHER CATEGORIES

Description		No.	average W_s
relative humidity temperature tailwind	< 60 % 0 - 20° C	18	< 5
relative humidity temperature tailwind	< 60 % ~~> 20° C~~ < 0° C	13	
relative humidity temperature headwind	< 60 % 0 - 20° C	28	
relative humidity temperature headwind	< 60 % ~~> 20° C~~ < 0° C	23	
relative humidity temperature tailwind	> 60 % 0 - 20° C	40	
relative humidity temperature tailwind	> 60 % ~~> 20° C~~ < 0° C	43	
relative humidity temperature headwind	> 60 % 0 - 20° C	58	
relative humidity temperature headwind	> 60 % ~~> 20° C~~ < 0° C	53	

FNLR TU-134

relative humidity > 60 %
temperature 0-20°C
headwind

	March 1974			Accumulation from November 1974		
judgement of approach	airline	number of approaches on RWY 25	W_a per approach	airline	number of approaches on RWY 25	W_a per approach
1	2	3	4	5	6	7
quiet approaching fleet				OK LO	49 45	< 5 < 5
noisy approaching fleet				LZ MA	23 12	6 9
total number of approaches of this type of aircraft and average W_a					128	< 5

Excessive noise events during this report period

at	airline	flight No.	landing time (GMT)	maximum level at measuring point I	II	III	IV	category No.	W_s
13.3.	SU	255	11.07	74	82	-	-	50	40
16.3.	LZ	127	18.19	74	78	-	-	58	21
16.3.	SU	001	15.18	74	82	-	-	58	37

WEATHER CATEGORIES

Description		No.	average W_s
relative humidity temperature tailwind	< 60 % 0 - 20° C	18	< 5
relative humidity temperature tailwind	< 60 % ~~[illegible]~~ < 0° C	13	
relative humidity temperature headwind	< 60 % 0 - 20° C	28	
relative humidity temperature headwind	< 60 % ~~[illegible]~~ < 0° C	23	
relative humidity temperature tailwind	> 60 % 0 - 20° C	40	
relative humidity temperature tailwind	> 60 % ~~[illegible]~~ < 0° C	42	
relative humidity temperature headwind	> 60 % 0 - 20° C	58	
relative humidity temperature headwind	> 60 % ~~[illegible]~~ < 0° C	53	

relative humidity > 60 %
temperature 0-20°C
headwind

FNLR TU-154

	March 1974			Accumulation from November 1973		
judgement of approach	airline	number of approaches on RWY 25	w_s per approach	airline	number of approaches on RWY 25	w_s per approach
1	2	3	4	5	6	7
quiet approaching fleet						
average				SU	18	5
total number of approaches of this type of aircraft and average w_s					18	5

Excessive noise events during this report period

nr	airline	flight No.	landing time (GMT)	maximum level at measuring point I	II	III	IV	category No.	W_s

WEATHER CATEGORIES

Description		No.	average W_s
relative humidity temperature tailwind	<60 % 0 - 20° C	18	-
relative humidity temperature tailwind	< 60 % ~~> 20° C~~ < 0° C	13	-
relative humidity temperature headwind	<60 % 0 - 20° C	28	-
relative humidity temperature headwind	<60 % ~~> 20° C~~ < 0° C	23	-
relative humidity temperature tailwind	>60 % 0 - 20° C	40	6
relative humidity temperature tailwind	>60 % ~~> 20° C~~ < 0° C	42	-
relative humidity temperature headwind	>60 % 0 - 20° C	58	5
relative humidity temperature headwind	>60 % ~~> 20° C~~ < 0° C	53	-

FNLR $^{118\text{-}06}$

relative humidity > 60 %
temperature 0-20°C
headwind

	March 1974			Accumulation from November 1973		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	2	3	4	5	6	7
quiet approaching fleet						
average				DA	11	13
total number of approaches of this type of aircraft and average W_s					11	13

Excessive noise events during this report period

at	airline	flight landing		maximum level at measuring point				category	W_s
		No.	time (GMT)	I	II	III	IV	No.	

WEATHER CATEGORIES

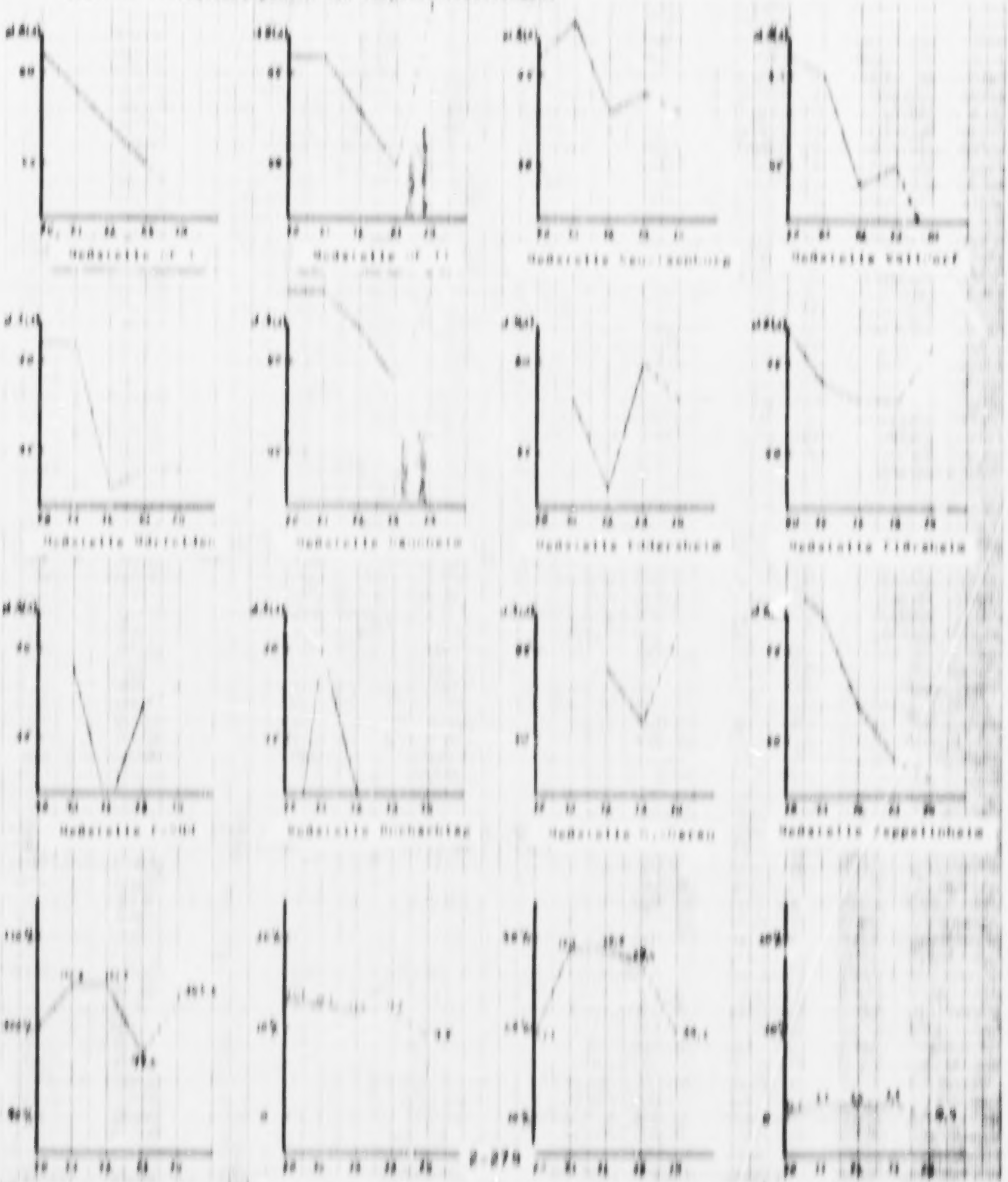
Description		No.	average W_s
relative humidity temperature tailwind	< 60 % 0 - 20° C	18	-
relative humidity temperature tailwind	< 60 % ~~> 20° C~~ < 0° C	13	-
relative humidity temperature headwind	< 60 % 0 - 20° C	26	-
relative humidity temperature headwind	< 60 % ~~> 20° C~~ < 0° C	23	-
relative humidity temperature tailwind	> 60 % 0 - 20° C	40	-
relative humidity temperature tailwind	> 60 % ~~> 20° C~~ < 0° C	43	-
relative humidity temperature headwind	> 60 % 0 - 20° C	58	12
relative humidity temperature headwind	> 60 % ~~> 20° C~~ < 0° C	53	-

FLUGHAFEN FRANKFURT/MAIN
AKTIENGESELLSCHAFT

Öffentlichkeit und Umwelt

Nr. 5 A

Entwicklung des äquivalenten Dauerschallpegels (dB(A)) - Gesamtschallpegel - in den Sommerhalbjahren 1970, 1971, 1972, 1973 und 1974 (Mai - Juni) an den Meßstellen bei fünffacher Gewichtung (gem. § 1 Fluglärmgesetz) der Geräuscheinwirkungen zwischen 22 und 06 Uhr und Entwicklung des Bewegungsaufkommens sowie Darstellung des prozentualen Anteils der Flugzeugbewegungen bei Betriebsrichtung [illegible] (Netzwetterlagen) in den Vergleichszeiträumen.



Meßstelle (F) I
Meßstelle (F) II
Meßstelle Neu-Isenburg
Meßstelle Walldorf
Meßstelle Mörfelden
Meßstelle Raunheim
Meßstelle Eddersheim
Meßstelle Flörsheim
Meßstelle F-[illegible]
Meßstelle Buchschlag
Meßstelle [illegible]
Meßstelle Zeppelinheim

Bewegungsaufkommen (Sommerhalbjahr 1970 = 100%)

Anteil des Bewegungsaufkommens zwischen 22 und 06 Uhr (00 bis 24 Uhr = 100%)

Anteil Betriebsrichtung West bei (00 bis 24 Uhr) am Bewegungsaufkommen (= 100%)

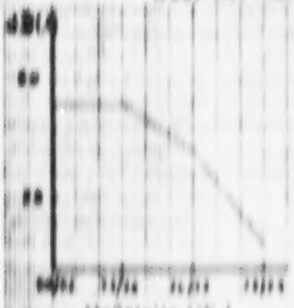
Anteil Betriebsrichtung West bei (22 bis 06 Uhr) am Bewegungsaufkommen (= 100%)

AR 115 [illegible]

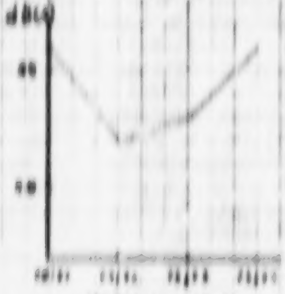
4.5 B

Öffentlichkeit und Umwelt

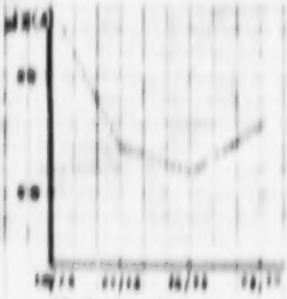
Entwicklung des äquivalenten Dauerschallpegels (dB(A), Gesamtschallpegel) in den Winterhalbjahren 1970/71, 1971/72, 1972/73 und 1973/74 (Nov. – 15. April –) an den Meßstellen bei fünffacher Gewichtung (gem. § 3 Fluglärmgesetz) der Geräuschereignisse zwischen 22 und 06 Uhr und Entwicklung des Bewegungsaufkommens sowie Darstellung des prozentualen Anteils der Flugzeugbewegungen bei Betriebsrichtung West (bei Ostwetterlagen) in den Vergleichszeiträumen



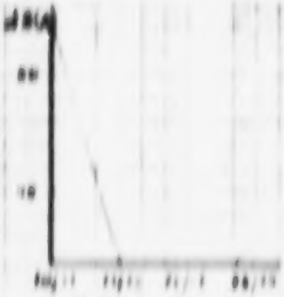
Meßstelle FF I



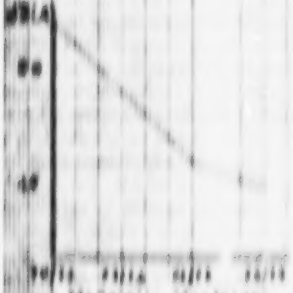
Meßstelle FF II



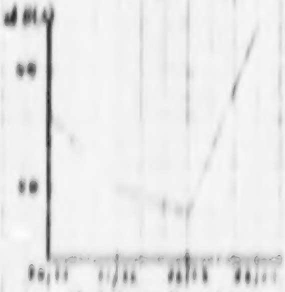
Meßstelle Neu Isenburg



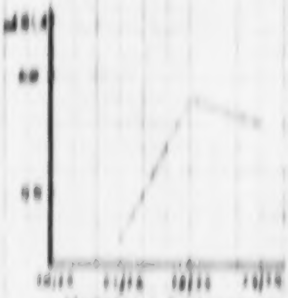
Meßstelle Walldorf



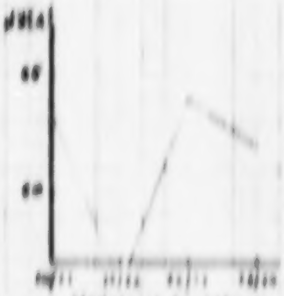
Meßstelle Mörfelden



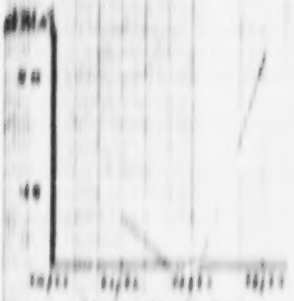
Meßstelle Raunheim



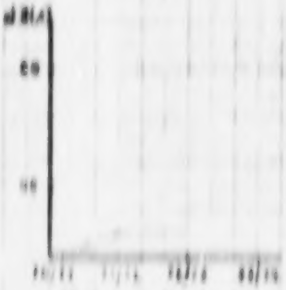
Meßstelle Eddersheim



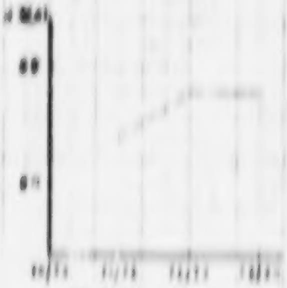
Meßstelle Flörsheim



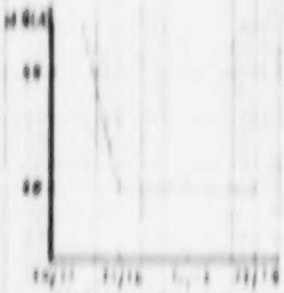
Meßstelle F. [illegible]



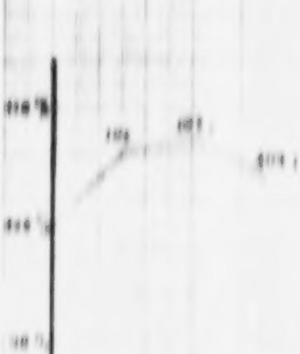
Meßstelle [illegible]

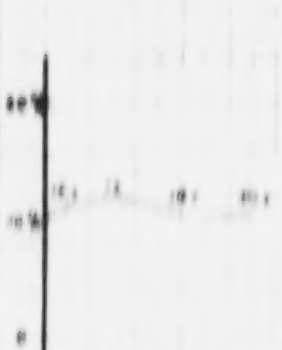


Meßstelle [illegible]

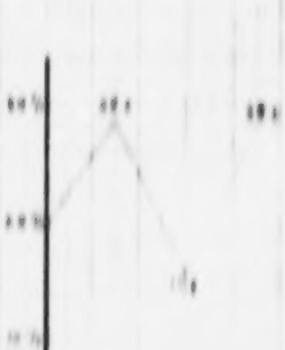


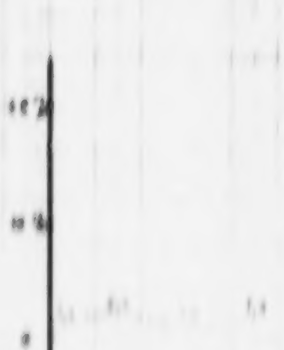
Meßstelle [illegible]


Bewegungsaufkommen (Winterhalbjahr 1970/71 = 100 %)


Anteil des Bewegungsaufkommens zwischen 22 und 06 Uhr (00 bis 24 Uhr = 100 %)

2-260


Anteil Betriebsrichtung West (bei 00 bis 24 Uhr) am Bewegungsaufkommen (= 100 %)


Anteil Betriebsrichtung West (bei 22 bis 06 Uhr) am Bewegungsaufkommen (= 100 %)

FLUGHAFEN FRANKFURT/MAIN AKTIENGESELLSCHAFT
NOISE ABATEMENT DIVISION

TABLE OF CONTENTS

		ISSUED PER:													
		MONTH	MONTH ACCUM. SUMMER	MONTH ACCUM. WINTER	WINTER HALFYEAR	SUMMER HALFYEAR	PER HOUR	TYPE	COMPANY	RWY/ZONE	MP	ROUTE	WEATHERCATEGORY	MOVEMENTS/EVENTS	MP IN OPERATION
20	LEQ NOISE EXPOSURE DEVELOPMENT	x	x	x			x			x	x				x
21	LEQ AVERAGE OF AC-TYPES IN WEATHERCAT.		x	x				x		x			x	x	
22	LEQ AVERAGE OF FLEET and RANK ORDER	x	x	x				x	x	x				x	
23	LEQ [illegible]	x						x	x	x			x		
24	LEQ AVERAGE OF LH FLEETS IN WEATHERCAT.				x	x				x			x	x	
30	[illegible] PER HOUR	x					x				x				
41	RANKINGS OF FLEETS	x					x					x		x	
42	RANKINGS OF AIRCRAFT CLASSES	x	x				x					x		x	

Nr 4

[illegible] [illegible]

[illegible]

[illegible]

[illegible] : [illegible]   [illegible] : [illegible]
[illegible] : [illegible]   [illegible] : [illegible]
[illegible] : [illegible]   [illegible] : [illegible]

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[illegible]   [illegible]
[illegible]   [illegible]
[illegible]

[illegible]

[illegible] [illegible]

[illegible]

[illegible] **[illegible]**

[illegible]

[illegible]

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[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

2.15 RHODE AND SCHWARZ

ROHDE & SCHWARZ

ROHDE & SCHWARZ 8000 MÜNCHEN 80 POSTFACH 801469

8000 MÜNCHEN 80
POSTFACH 801469

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Telefon: (München) [illegible]
Telex: [illegible]
Drahtwort: Rohdeschwarz München
Bahnverbindungen: München Ost
Banken: Deutsche Bank AG
Filiale München [illegible]
Bayerische Staatsbank München [illegible]
Postscheck: PSchA München Kto. [illegible]

Hydrospace-Challenger Inc.
1360 Rosecrans Street
San Diego
California 92106
USA

Übermittelt durch:
Rohde & Schwarz
Sales Co. Inc.
111 Lexington Ave.
802 Passaic, New Jersey
USA

Ihre Zeichen / Nachricht vom
Unser Zeichen: Our ref. 1STV-Hi 5200-Newt
Bearbeiter: Herr Schlenkat
Telefon: (089) 4129 3714
München den 2 Aug. 1974

Ref.: HO I O – Questionnaire on ROHDE & SCHWARZ Aircraft-noise Monitor

Dear Sirs,

Many thanks for your letter of 9 July 1974 sending us the questionnaire on the aircraft-noise monitoring systems. You request us to fill out this questionnaire as detailed as possible. Unfortunately, for personnel reasons, it will be impossible for us to devote our attention to this for the next few months.

We would have to clear up a considerable number of questions direct with an airport – we are thinking of Munich's airport at Riem – since your questionnaire enters into purely technical aspects of the aircraft-noise monitoring systems. We suspect, however, that you have sent your questionnaires not only to the manufacturers but also to the users of such systems, in which case you will be able to gather information much better from the latter on their experiences with the Rohde & Schwarz aircraft-noise monitoring systems. For your information, we have installed such systems at Munich, Frankfurt, Düsseldorf and Amsterdam, to name a few.

The last of our installations was that at Munich-Riem about two years ago. In the meantime the concept has been updated. The transmission of data is no longer made in analog form, i.e. involving frequencies between 300 Hz and 3 kHz, but by digital means. The analog electrical data from a sound event are digitized and passed on to a central evaluation station by modems. The evaluation of the data in this central station is no longer made with a 12-bit PDP computer from Digital Equipment, but with a 16-bit NOVA 2/10 from Data General. The evaluation itself, however, has remained unaltered.

We hope you will appreciate our reasons for not being able to comply with your wish for filling out the questionnaire. If you do actually receive information on this matter from airports using the systems, and there are still some questions unclarified, please feel free to contact us at any time.

Yours sincerely,

ROHDE & SCHWARZ

i.A. i.A. Schlenkat

468 511170